



PSALM. CXXXVI. Ver. 4.
By Gods All-powerful Hand
Amazing Works are wrought;
The Trees, Birds, Beasts, and Fish,
Are to perfection brought.

B. Cole sculp

31,270
Spectacle de la Nature:
OR,
NATURE DELINEATED;
BEING
Philosophical Conversations.

WHEREIN

The wonderful Works of PROVIDENCE,
in the Animal, Vegetable and Mineral Creation are
laid open; the Solar and Planetary System, and
whatever is curious in Mathematicks explain'd.

The Whole being a Complete Course of Natural
and Experimental PHILOSOPHY, calculated for the
Instruction of YOUTH, in order to prepare them for
an early Knowledge of NATURAL HISTORY, and
create in their Minds an exalted Idea of the Wisdom
of the GREAT CREATOR.

Translated from the Original *FRENCH*, by
JOHN KELLY, of the *Inner Temple*, Esq;
D. BELLAMY, of *St. John's College, Oxford*; And
J. SPARROW, Surgeon and Mathematician.

*The Whole embellish'd with a great Variety of COPPER-
PLATES, beautifully engraved by the best Hands.*

The Fourth Edition, with large Additions,
Carefully Revised and Corrected: With a particular *Table
of Contents*, and a general *Copious Index* to each Volume.

V O L. I.

NATURE is Nothing but the ART of GOD; a bright
DISPLAY of that WISDOM, which demands an Eternal
Tribute of Wonder and Worship. I. WATTS.

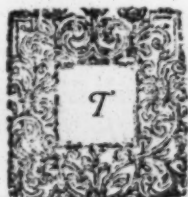
L O N D O N:

Printed for JAMES HODGES, at the *Looking-Glass*,
near *London-Bridge*. 1757.





THE
EDITORS
TO THE
READER.



14 2 07.
THE First Impressions of these PHILOSOPHICAL CONVERSATIONS, (notwithstanding the vigorous, tho' fruitless efforts of some few disingenuous and self-interested Booksellers to discourage and obstruct the sale of it) having met with a more favourable acceptance from the world than could reasonably be expected, we thought ourselves obliged, in point of gratitude, to prevail on the several Gentlemen concern'd for us, to revise their respective labours; and by such emendations and enlargements, as they should find convenient, render this Edition more perfect and complete, and a more acceptable service to the publick: And such as it now stands, upon their strict and careful review, we flatter ourselves, the Whole is in every respect equal, and in some particulars superior to the Octavo Edition, (so very much boasted of, and usher'd into the world under the specious name of the late ingenious Mr. Humphreys) tho' not above half the price: For we are now authorised to assure our readers, that as there are no voluntary retrenchments on the one hand, so there are no arbitrary interpolations on the other: Whereas the above-named

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translator (who died before the work was half finish'd) or his assistants rather, whoever they might be, have taken the freedom to abandon their original at pleasure, and to substitute such new-collected matter in the room, as to them in their great wisdom seem'd most meet and convenient. Whether indeed so bold an attempt was the pure result of their own choice, or wholly owing to the direction and artifice of the Proprietors, to swell the number of sheets, and enhance the price, we shall not presume to determine: But whether such treatment of a foreign author, especially one so judicious, and so universally admired as Abbé LE PLUCHE, be generous and justifiable; or whether it be not a flagrant indignity offer'd to his character and merit, is submitted to the decision of every impartial reader. We shall now conclude with this one hint further, in favour of the following sheets; that we have not only prefix'd to each volume a large table of Contents, which, tho' highly necessary, has hitherto been wholly neglected by the Editors of the other translation; but have added complete Alphabetical Indexes to the same.





T H E
A U T H O R's
P R E F A C E.



OF all the various plans that have been formed with success, for the education of youth, and their early improvement in the art of thinking, THAT of exciting their curiosity has always produced the surest and most lasting effects. A thirst after knowledge, as well as reason, is implanted in our natures. It exerts itself in all ages, but never with more vivacity than in youth; when the mind, being uncultivated, eagerly catches at every object that presents itself to her view, is charmed with novelty, and contracts with ease an early habit of attention.

Nothing could ever prove more beneficial to us, than this happy disposition, was it but employ'd on such objects as are equally instructive and entertaining. Now the study of nature is attended with both

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those advantages, in their utmost degree of perfection; whether we consider her assemblage and regular formation in the whole, or strictly observe the symmetry and proportion of each individual part. All her works are capable of giving us both instruction and delight; since all are the visible effects of harmony and art. The most minute, as well as the largest bodies, inform us of some truth, have all a language, in which they address themselves to us, and indeed to us alone. Their particular structure affords us some kind of improvement. Their determination to some end clearly intimates the intention of the Great Author of their Being. The relations which they bear to us, as well as to each other, are so many distinct voices, which demand our attention, offer us their assistance, and, by their admonitions, furnish us with all the conveniencies of life, adorn our minds with truth, and make our hearts even glow with gratitude. In short, it may with justice be asserted, that no book is so learned and compleat, as that of Nature; no one so well adapted to cultivate our reason; since at once she comprehends the objects of every science, and her instructions are confined to no particular language, or nation whatsoever.

From this volume of the creation, so obvious to every eye, and yet so little perused or regarded, we shall make, if we may be allow'd the expression, some curious extracts, in order to convince our young readers of that inestimable treasure which they are possess'd of, without the enjoyment of it; and to lay before them a prospect of such things as may possibly have escaped their observance, by means of their distance and minuteness, or through want of attention. Instead of proceeding, according to the usual methods, from general axioms and universal ideas, to such as are more particular, we
imagined

imagined ourselves indispensably obliged, in the course of this undertaking, to pursue the order observed by nature herself, and to treat of those objects first which surround us, and present themselves every moment before our eyes; that is to say, of animals and plants. We thought proper to begin with the former, and those too of the minutest size. From insects, and other little reptiles adorn'd with shells, we have proceeded to birds, beasts, and fishes. Having made a sufficient enquiry into some of the numerous advantages which we reap from them, we pass on to those which arise from the vegetable part of the creation; endeavouring throughout our whole design, by introducing an agreeable variety, to instruct and amuse the reader at the same time. If we have not been so strictly regular and methodical, as might possibly be expected, we flatter ourselves, that, as we propose to conduct the mind to truth, we may be allow'd to deviate sometimes from the direct road, where we find it too heavy and rugged, and to strike into a more smooth and delightful path, provided it equally tends to the point proposed.

However, as it is not sufficient to give the mind a bent, or inclination to be curious, by amusing it with delightful prospects, unless we instruct it likewise to be modest, and cautious in its enquiries; we have annex'd to this *First Volume* a *short essay*, by way of *letter*, on the *power and insufficiency of reason*, its great interest consisting in the enjoyment of whatever is accommodated to it, without vainly pursuing what is too mysterious, and what we have no right or title to approach.

Our intention in these *First Essays*, as well as those which we may possibly publish hereafter, has been, not so much to collect all the abstruse learning we could

could find under each particular topick, as to produce what, in our opinion, appears to present itself with most ease to the first efforts of reason, to be most agreeable to the taste, and most suitable to the necessities of those readers for whose amusement they were principally intended.

We have not entit'ed these our dialogical lectures, *The Natural Philosophy of Children*; though that, doubtless, we might have done with propriety enough, had we intended them for the use and improvement of youth in schools only: Neither did we think fit to range them under the general term of *Physicks*; being conscious to ourselves, that we should then have promised much more than we have actually performed; since we had no intention to compile a system for the service of such as have made much greater advances: We have therefore concluded to publish them under the plain and simple title of *Nature Delineated*, which implies no more than the visible parts of the creation; and those objects which strike the sense, and fully express all that class or order of beings which is obvious to the eyes of all mankind, is comprehended with ease by the tenderest capacities, and which no one can possibly be unacquainted with more or less. We all enjoy the common blessing of sight, and the external part of nature is ever before our eyes. This survey of it is for us. In confining ourselves to such objects, we discover, in the most minute part of them, not only beauty and order, but instruction and truth. We are well assured that they exist; we see their form, and feel the effects of their goodness; we calculate their number, and discover their properties, relations, tendencies, and use. Here is sufficient scope for the free exercise and improvement of the mind. Every new discovery is an additional amusement. Our riches visibly increase

crease in proportion, and the survey of so many bounteous benefactions must of necessity banish from our hearts all lukewarmness and ingratitude. Should we, indeed, be ambitious of prying into the inmost recesses of nature, of tracing effects to their original causes, and of comprehending the artful motion and elasticity of each secret spring, and of the minutest elements wherof they are composed, the attempt, we confess, would in us be vain and presumptuous. Such arduous undertakings we shall freely submit to those of a superior genius, who have judgment and penetration sufficient to enter into, and behold those profound mysteries. As for us, we think it more modest to treat of the external beauties of the creation only, and the effect of those machines which constitute the delightful prospect. Here we have free admission: Here we may plainly discern, that each object was adorned with such transcendant beauty, on purpose, as it were, to engage our most serious attention. However, contented with a view which sufficiently gratifies our senses, and informs our judgments, it is by no means requisite that we should expect to have the secret repositories of those machines at once laid open to our view. All we aim at, in short, is this; to make choice of such subjects, out of the gay scene of nature, as will strike strongest on the imagination, and exercise our rational faculties with the most improvement, without once entring upon any topick that may seem either above our reach, or may toil us in the pursuit, by being too intricate and abstruse.

As to our plan, we have endeavoured to avoid every thing which we imagined might give the least distaste; and instead of a regular discourse, or one long chain of dissertations, which too often prove tedious and disagreeable, we have made choice of

the dialogical style, as being most familiar, natural, and easy, and most likely to engage the attention of all sorts of readers. We shall now proceed to give some short account of the several characters which we have introduced, and of the particular place where we have laid our scene.

A young gentleman of quality, whom we shall call the *Chevalier du Breuil*, pays a visit, in the vacation from his usual exercises at college, to a gentleman of *Picardy*, who receives him with all the joy imaginable, being the son of a very affectionate friend, who was gone for some time to *Amiens*, in order to settle an affair of importance to the family. This gentleman, whom we shall distinguish by the name and title of the *Count de Jonval*, employs all his leisure hours in the study of nature; and finding the *Chevalier* to be an ingenious youth, and very curious, determines to take a walk with him every day, either in his garden, or some of the adjacent meadows, as soon as he had dined, and paid the necessary compliments to his other visitors, and more general acquaintance. Their discourse always turns upon some branch of natural philosophy; and in order that their conferences may not be interrupted, when his other avocations require his absence, he makes the *Prior*, curate of the place, a very learned, pious and polite gentleman, one of their party. Soon after, the *Countess de Jonval* desires to be admitted a member, and to share in their conversation. As to her character, she is a very grave lady, yet innocently chearful and active; ambitious of adorning her mind with all kinds of useful knowledge; and, in a word, a shining example of virtue and good manners. Sometimes our choice, and sometimes the *Chevalier's* curiosity, determines the subject-matter of their debates. As they seldom enter upon any topicks but what are

easy and intelligible, yet at the same time novel to the latter, he takes particular care, on their return in the evening from hunting or fishing, to commit to writing the sum and substance of the day's conversation: After which, he submits his manuscript to the revial and correction of the *Prior*; and that manuscript, so altered and improved, the reader may imagine to be the conferences which we here offer to the publick.

If these amusements, or studies at our vacant hours, should meet with a favourable reception from our young pupils, especially our young nobility, who, as they frequently reside in the country, are more familiarly acquainted with the curiosities of nature, than others of a meaner station; we may possibly renew these dialogical entertainments at a proper season, and use our utmost endeavours to substitute a taste for the charms of nature, and the love of truth, in the room of that false marvellous, so conspicuous and glaring in those fables and romances which we daily see revived in a thousand shapes, notwithstanding the general contempt they lay under for a long time, through the good sense and just discernment of the last age.

What pains soever we have been at to procure, either by our own industry, or the communication of our friends, the remarks on nature, inserted in the following dissertations, we have taken particular care to quote the most celebrated authors in the margin, who have made the like observations. We did not think it any ways incumbent on us to introduce what the antients have advanced on some of our topicks, since they were too often more credulous than exact, and we doubt not, but that the generality of our readers will be much better pleased with the testimonies of our modern philosophers,

who are universally esteemed for their circumspection and exactness. The works which we have principally had recourse to for our own information, and the defence of our remarks, are, *The Learned History and Memoirs of the Academy of Sciences at Paris*; *The Philosophical Transactions of the Royal Society in London*; *The justly-admired Dissertations of Malpighi, Redi, Willoughby, Leeuwenhoeck, Grew, Nieuwentit, Derham, and some other Naturalists of equal reputation.*



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OF THE
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TO THE
FIRST VOLUME.

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OF



Of INSECTS.

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DIALOGUE I.

The Count de Jonval. The Prior de Jonval.
The Chevalier de Breuil.

Count.  Plainly perceive, my dear Chevalier, that unless I lock you out of my study, we shall have no walk to-day. The evening draws on a-pace. Let us be gone.

Chev. And here comes the Prior very opportunely to make one of the party.

Prior. Gentlemen, if you are disposed to refresh yourselves, and take a tour in the garden, I shall be proud to wait on you. I see, my Lord, we must turn the Chevalier out of your closet, where I constantly find him. One would imagine, that 'twas some post which he was oblig'd in honour to maintain.

Chev. 'Tis with reluctance, I confess, whenever I quit it. His Lordship has fill'd it with so many curiosities, that 'tis impossible to be tired with beholding them.

Count. Do you really think so? — No, Sir, Paris is the place to strike your eye. Here you will find nothing but simple nature.

Chev. And she, Sir, in my opinion, is infinitely more engaging, than all the pageantry and splendor of a court. We are soon tired with the sight of the gayest objects, when once they grow familiar to the eye; but

here is a perpetual variety, an assemblage of every species of animals from each quarter of the world. Some of them are the actual works of nature, both artfully dried, and carefully preserv'd; and others are well express'd in picture. Nothing, however, can be more entertaining, in my opinion, than this vast number of minute animals that are all alive: Some of them, I perceive, are very busy in the window under a glass hive; others are either spinning, or employing themselves in their own way in chrystal vases.—How delightful is a country life, where new objects are for ever presenting themselves to our view!

Count. Every one has a taste peculiar to himself. Retirement, I own, is mine. These amusements to me are not only agreeable, but advantageous; an enquiry, however, into the structure of butter-flies, silk-worms, ants and bees, must, to a gentleman of your gay disposition, prove but a very languid entertainment.

Chew. You are mistaken, my Lord. Since I have been acquainted, through your indulgence, with the use of the microscope, I have observed several things exceedingly surprising in Insects. The little head of a fly is embellish'd, I find, with flowers and diamonds. The wing of a gnat, which at first view seems unworthy of the least regard, when survey'd with attention, appears as smooth as glass, and glows with all the colours of the rainbow. My curiosity will never be satisfied, till I have examin'd all the rest with equal care and circumspection.

Count. Can you bear then the imputation of being singular? Be ingenuous: Are there any of your friends or acquaintance that amuse themselves with Insects? They are for the most part actually destroy'd, or at least but little regarded. If you propose to regulate your pleasures by mine, you'll make choice of a very unfashionable model. He that would be thought a man of taste must be extremely delighted with the hurry and bustle of a town life; must dress after the newest mode; be very exact in the choice of his equipage, and study all the graces that are peculiar to the snuff-box: His whole morning must be spent in making out a bill of fare for a collation at night; and when that important
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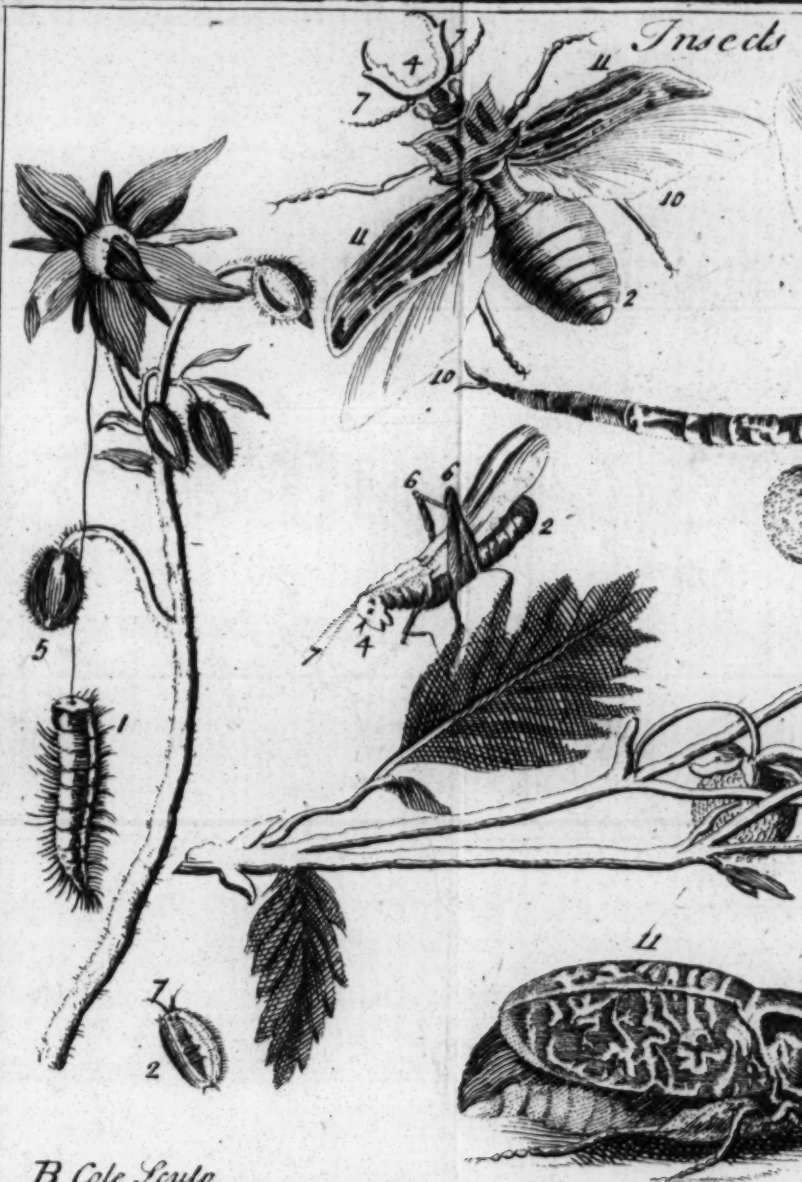
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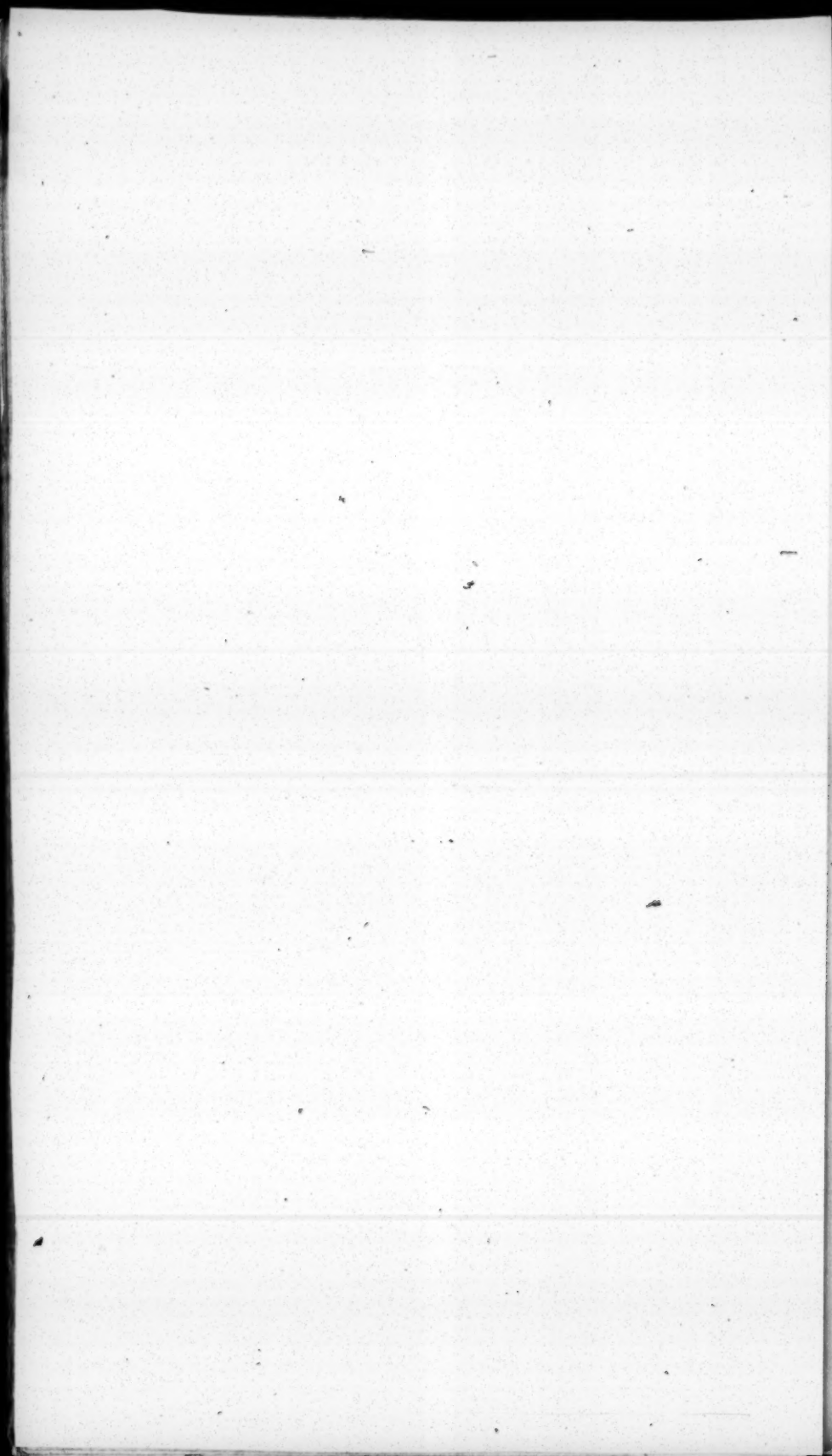
Insects



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seeds





article is once adjusted, the remainder of the day must be devoted either to the Withdrawing-room, or the Groom-porters. He must shine, in short, in the side-box at the opera, and have a peculiar relish for all the dextrous feats and magical transformations of *Harlequin* in a pantomime entertainment. These are your men of mode, and these the amusements which at this time of day meet with universal approbation: But to spend three parts of the year in four, like me, in the country, and make the various scenes of nature your principal study and delight; to pry, for instance, into the structure of an animal's body, to trace a plant from its origin to its utmost state of perfection, and to find out by repeated experiments the particular uses for which it was intended; What think you, I say, my dear Chevalier, of a such waste of time, such an awkward, unfashionable course of life? Is not there something in all this that favours too much of the dreaming philosopher?

Chev. I comprehend your Lordship. You would intimate, that the generality of mankind form a wrong judgment of things; are fond of what is trivial; and neglect that which is truly solid and substantial.

Count. Since you conceive me so readily, I'll proceed without reserve. I am charm'd, I confess, with prying into the secret beauties of nature. I find new objects every day to amuse me.

We will not begin then with taking a survey of those glorious orbs that roll above us, nor of this earth that exposes such immense treasures to our view; but in the first place, if you please, Sir, we'll take the minutest objects into our serious consideration, and afterwards ascend by slow degrees. The scene which we behold is truly grand and magnificent; but what our eye cannot take in at once, may be divided, and enjoy'd in parts."

Let us begin then with these Insects, so much neglected and condemn'd by others, but admir'd, Sir, by you. The minutest of them all (when I reflect not only on their variety, order, proportion and policy; but the wondrous exactness and delicacy of their organs) give me incredible delight. If the Divine Wisdom thought fit to create them, shall we look on them as objects unworthy of our notice? Judge, Sir, by what is obvious

to our observation, how much those charms which lie conceal'd from our eyes and reason, were they once unveil'd, would excite our admiration.

Every Insect that flies or creeps, is a little animal, consisting of several ringlets, which shrink from, or draw near to one another by one common membrane, or skin that collects them; or else, of distinct scales, which play to and fro, by gliding over one another; or, in short, of two or three principal parts, which have no other connection than a ligature, or little thread.

Of the first kind are all worms in general; as well such as have feet, as those that have none. When they are disposed for motion, they extend the musculous skin which divides the two first ringlets. They advance that nearest the head, and sometimes that nearest the tail, to a certain point. Then the second ringlet is drawn after it, either by contraction, or expansion of the membrane which belongs to that particular part. The third and fourth, and so the whole body successively, moves along by the same effort. Even those little animals that have no feet, pass in the same manner from one place to another, rise out of the ground, or withdraw into it, upon the least apprehension of danger; and in short, proceed or retreat, as occasion requires.

Of the second kind are flies, may-birds, &c. whose bodies are an assemblage of divers little scales, which by unfolding expand themselves, or by sliding over one another, contract, like brassets, in a suite of armour.

Chev. I have seen several of them in your Lordship's wardrobe.

Count. Of the third kind are ants, spiders, &c. whose bodies are divided into two or three parts, and whose connection is imperceptible, at least, to the naked eye. As to the term *INSECTS*, which is applied in general to all these *Animalcula*, it takes its derivation from the *Latin* word *Insecare*, to cut.

Though their minuteness, at first view, may seem a just argument for that contemptible idea which the vulgar entertain of them; tho' the unthinking part of mankind may look on them as the result of chance, or the refuse of nature; yet he that views them with due attention, and reflects on the art and mechanism of their structure,

structure, which collects such a number of vessels, fluids, and movements into one point, and that too frequently invisible, cannot but discover an all-wise Providence, that is so far from treating them with neglect, that he has not only clothed them with a profusion of pomp and magnificence, but furnished them with all such warlike instruments as are requisite to their condition.

The Divine Wisdom has cloth'd them with abundance of complaisance, by bestowing on them such a profusion of azure, green, and vermilion, gold and silver, diamonds, fringe, and a gay particolour'd plumage. We need only take a view of the *Ichneumon*, the *Spanish* fly, the butterfly, or even a caterpillar, to be struck with astonishment at this pomp and grandeur.

The same Divine Wisdom, which has been thus indulgent to them in their dress, has also arm'd them with proper weapons from head to foot, and enabled them either to engage their enemies, or, as occasion requires, to make a vigorous defence. If they are not always victorious, or sometimes do not escape the danger that threatens them, yet still they are provided with proper abilities to render their attempts successful.

Most of them have either strong teeth, a double saw, a sting with two darts, or else tenacious claws. Their whole bodies are cover'd over, and secur'd by a scaly suite of armour. Such as are of a more delicate and tender nature are fortified with a thick skin, which gives a check to the violence of those frictions and encounters, that might otherwise prove injurious to them. Their security, for the most part, depends on their sprightliness and activity. Some, by virtue of their wings, avoid the danger that attends them; others, that dwell on the leaves of trees, precipitate themselves from their enemies by a fine thread that supports them; others again, by the elastic force of their hind feet, launch themselves in an instant out of the reach of any pursuit, or the hazard of any hostile engagement. In short, when they find themselves unable to withstand the insults and attacks of the more potent foes, they have immediate recourse to some artful stratagem for the accomplishment of their designs; and although that perpetual war which we observe to be maintain'd between them, supplies many

of them with their daily subsistence ; yet it preserves, at the same time, a sufficient number of them to perpetuate the species.

Let us now take a survey of the various organs which nature has bestowed on them for their maintenance and support ; and of the respective utensils or implements, with which each of them performs his work ; for all of them have different trades and occupations. Some employ their time in spinning, and have for that purpose two distaffs, and two fingers, as it were, to form their thread. Others are curious in net work, and are provided accordingly with clews and shuttles. Some build in wood, and are therefore furnish'd with little hatchets for hewing of their timber. Others are engaged in wax-work, and have their cells, or lodgments, full of rakers, ladles and trowels. Nature has bestowed on most of them a more commodious *proboscis*, or *trunk*, than that of the elephant, which some make use of as an alembick, to distil a certain syrup, which all the art of man can never imitate ; others, as a tongue, to distinguish what is most agreeable to their taste ; some, as a drill, or auger, for piercing any solid substance ; and all of them, or the greatest part, at least, as a reed for suction. Some are not only provided with this trunk, but with a kind of auger—in their tails, which they dart forth, and retract at pleasure ; and therewith dig cells, or little lodgments for the accommodation of their young, in the heart of fruits, the bark of trees, the most substantial part of leaves or gems, and often too in the most stubborn wood. Such as have curious eyes, have likewise for the most part a pair of *Antennæ*, or little horns, that guard and secure them ; and as they move along, especially in the dark, make tryal of the ground, and discover, by a quick and delicate sensation, what would prove injurious to them, plunge them into immediate distress, or expose them to any danger. If these *Antennæ* happen to be moistened by any pernicious liquor, or give way by the obstruction of any solid body, they are forewarned, turn short, and steer a safer course. Some of these horns consist of little knots, like those in the head of a cray-fish ; some terminate in the form of a comb ; and others are either cover'd with feathers,

like

like down, or deck'd with a tuft of hair, to secure them from any moisture. Most Insects, besides the several conveniencies before-mentioned, have likewise the faculty of flying. Some have four large wings, in proportion to the extent of their bodies. Others, whose wings are so exquisitely fine that the least friction would tear them, have two large scales, which they erect or depress as wings, tho' they are, in real ty, no more than cases. There are great numbers likewise that have two wings only, but under them two bladders, which when extended are easily discerned, and are looked upon by Naturalists, as two * counterpoises, or equal weights, by virtue of which the Insect (like a rope-dancer with his pole) supports itself against the agitation of the air, and continues in æquilibrium.

I perceive, my dear Chevalier, by the attention which you give, we shall make a philosopher of you.

Chev. As I shall have the honour of living with your Lordship for a considerable time, I shall grow rich at your expence. If you will excuse my freedom, I shall ask you a hundred questions every day. I intend every class of animals shall pass in review before me. Every blade of grass I meet with will give me room to break in upon you. In short, I shall never let you rest in quiet till I have exhausted your whole stock of knowledge.

Count. Tho' my stores are easily drain'd, yet nature, Sir, is an inexhaustible source.—Do your best; begin your attack as soon as you please. We'll be upon our guard.

Chev. Since your Lordship has oblig'd me with so particular a detail of their resplendent dress, their warlike weapons, and the numerous implements of their respective professions, I must beg the favour of seeing them in one of your microscopes. According to your account, their attire is as gay as ours, and their utensils as artfully contriv'd as those of our best mechanicks.

Count. Doubtless they are. But then we must farther observe, that our works, when set in competition with those of nature, are all inelegant and incomplete. Do but observe the head of a common fly in a magnifying

glass! * What a profusion of gold and pearl will you discover there! What has been said of the lillies of the field, may be justly ascribed to the *Ichneumon* fly, and many others of a different species; *Solomon* in all his glory was not arrayed like one of these.—But to return to what you have seen before. If you remember, I shewed you in my microscope some time ago, the sting of a bee, and a fine needle glew'd on a small piece of paper. Pray what observation did you then make with respect to the sting?

Cher. It was polish'd in the most beautiful manner from one end to the other, and the point was imperceptible.

Prior. There was something farther worthy of notice, which his Lordship forgot to mention at that time. Not far from the point there is a small orifice, through which the bee emits two darts, which, tho' inexpressibly fine, are very strong and pungent; insomuch, that what you saw, and what commonly launches out from the body of the bee, is not properly speaking its sting; but the case, or sheath in which it is inclosed.—But pray, what appearance did the fine needle make?

Cher. It seem'd all unpolished and rugged, like a bar of iron out of a smith's forge.

Prior. Your comparison is just; and 'tis the very same, indeed, in every thing else. † In all human operations, you observe nothing but wide gaps, and inequalities. The narrow bounds of man's abilities, the roughness of his tools, are visible throughout the whole. Every thing appears as if it had been hack'd with an ax, or laid on with a trowel. Every thing, in short, demonstrates the imperfection of the artificer; whereas, on the contrary, the smallest works of the Creator are every way complete. There is that freedom, that pliantness, those secret springs in their internal parts, the structure, art, and correspondence whereof are known by him, and him alone; and moreover, the most beautiful strokes of the pencil, all the pomp and grandeur, all the symmetry and proportion, and, in short, all the graces in their external form that can possibly be imagined.

Cher.

* Expl. lit. de l'Ouvr. de six jours.

† Wilkins's Relig. Natur. lib. i. c. 6.

Chew. I am fully determin'd to study all the Insects that I can possibly meet with. I'll be thoroughly acquainted before I have done with every species.

Prior. Give them no quarter; especially such as attract the eye by their lively colours. I pity every butterfly and every luminous animal that falls in your way. However, as the Chevalier, my Lord, is so extremely fond of Insects, 'tis no hard task to give him the satisfaction he requires. Let us therefore amuse him with a particular detail of the various transmigrations through which they pass, and their various species. By that means he'll be enabled to collect those which strike his fancy most, to range them in their proper order, and be intimately acquainted with his whole retinue.

Count. With all my Heart. We will begin then with the origin, or first state of Insects. Each proceeds from an egg, in which the seed and first nutriment is enclosed. This egg is the product of a male and female. The latter makes choice of such a place to lay her eggs in, as appears to her most commodious, and where she imagines there is heat sufficient to hatch them, and where her young, when they are released from their confinement, will find all convenient subsistence in the places round about them. In short, insects, like all other animals, are first produced by way of generation, and then come to maturity by gradual culture, which preserves the species.

Chew. Every insect then, I find, owes its being to a male and female.

Count. That is a truth confirm'd by so many naturalists, that 'tis now become a general rule. But what puts the question past all dispute is, that these *Animalcula* themselves are either male or female, produce eggs, and lay the foundation of a numerous progeny. Can we imagine, that infants should be born by the way of generation, and that their parents should owe their existence to some other original?

Chew. No, sure; 'tis a very improbable supposition. God created at first one man and one woman, from whom all the race of mankind are descended. He created likewise one lion and one lioness; from them all beasts of that denomination proceeded; and 'tis equally

evident, that every insect in the same manner has multiplied its species.

Prior. But how then shall we reconcile this regular generation of insects with the vulgar notion, that they derive their existence from corruption?

Chev. This, Sir, I must confess, to me seems a very just objection; for 'tis plain, that all matter, when corrupted, produces worms.

Count. Most people say so, indeed: But do you imagine, Sir, that they understand what they assert? Is not the corruption of a body, the dissolution of its parts? Meat, drink, and wine itself, for instance, will decay, when the air, especially in summer, penetrating their pores on every side, disperses their finest particles, and leaves behind only such as are gross, unwholesome, and disagreeable to the taste. Is it to be supposed, that the internal part of a piece of meat, so blown and changed, should become better qualified, all at once, for the construction of an organiz'd body, that has eyes, a heart and entrails; and, in short, every individual part that constitutes a living creature?

Chev. How, my Lord! do you really think, that a worm, or a caterpillar, is so completely form'd as you seem to intimate?

Count. The most minute worm, the least mite that is visible in cheese, or the smallest eel that swims in vinegar *, has all the parts above specified, is an animal that fees, turns aside when any thing obstructs its passage, is in constant pursuit after its proper food, eats and digests; has all in miniature, which we can boast of in larger dimensions; and I would as soon assert, that rocks or woods engender stags or elephants, as that a piece of rotten cheese produces mites. Elephants and stags are born and live in woods, and mites in cheese; the existence, however, of both is owing to the same original. Our magnifying-glasses, and the anatomy of insects, have cleared this truth to a demonstration; and tho' their uniform and regular generation was a mystery in former ages, 'tis now sufficiently revealed.

Prior.

* See the tables of Leticuwenhoek under the term *Animalculæ*.

Prior. With your Lordship's permission, I will convince the Chevalier by a few more solid and substantial arguments. The vulgar notion, that insects owe their being to corruption, casts a reflection on the great Author of Nature, and is a reproach and dishonour to human reason. For, if we will but bestow the least serious thought on these diminutive creatures, in whose structure so much harmony and contrivance is conspicuous, who are so plentifully provided with all things needful, and who perpetuate their species in one form, without the least variation, we must either acknowledge, that an Almighty Power created them, or that they are the result of chance, and the fortuitous concurrence of some humours which have been alter'd and displac'd. Now 'tis absurd and ridiculous to the last degree, to imagine, that chance acts; or to affirm, that she acts with any design, regularity, or precaution. Thus the same All-wise Providence, that engages our admiration in the structure of a human body, is equally conspicuous in the composition of an insect; and putrefaction is no more the parent of these *Animalcula*, than of larger animals, or of man himself. The next point we have to consider is, whether insects, wherever we meet with them, are generated by virtue of a new and an extraordinary creation; or from certain seeds, which God from the beginning implanted in each species, and wherein he hath modelled, and designed in miniature, the organs of future animals, which time is to unfold. This last notion seems most conformable to reason and experience, to the omnipotence of the Supreme Being, and to the sacred Scriptures; wherein we are told, that God from the beginning ordained that every plant should have seed in itself of its own likeness, and that every living creature should increase and multiply according to its species.

Chev. I begin to see the force of your arguments: But 'tis no easy matter to shake off so received an opinion, as that of putrefaction being the parent of insects; since we see, by daily experience, that as soon as wood begins to grow rotten, or meat to stink and decay, that an infinite number of living creatures are instantly swarming about them.—How do you account for their production?

Count.

Count. Nothing can be more natural. They are engender'd in such corrupted matter ; because other insects have been first attracted to it by the smell, and laid their eggs there.

Chev. But then, my Lord, they must be universally dispers'd, and every place must be full of them ; for otherwise, a thousand things would putrify without the visible production of any worms.

Prior. The Chevalier seems still to want further conviction, because he perceives numbers of worms wherever there is any putrefaction : This induces him to imagine, that eggs are universally distributed, and brought to maturity in those places only, where they meet with such juices as are most fit to swell, and nourish the seed.

Chev. I have heard his Lordship say, that the little seeds of plants are waisted up and down by the wind, and scatter'd all about ; and that they begin to shoot at last, when they find juices proper for them. Why should not the same argument hold good, with respect to the distribution of insects eggs ?

Count. Did not I tell you we should make a philosopher of you ? Your father, and your tutor, at their return, will find you an adept in physicks. I can't say but I am pleas'd that you have struck into such a way of thinking. Some of the moderns, indeed, as well as many of the ancients, maintain'd the same notion. I would not advise you, however, to lay too great a stress upon it. For altho' the supposition may seem plausible enough, yet I'll soon convince you, that it is not altogether just.

A plant is rooted in the earth, and cannot stir to convey its seeds to any distant place ; for which reason, nature has bestow'd wings, as it were, upon them ; in order to disperse them. Some break their shells with force and vigour, and spread themselves far and wide. Others are actually supplied with wings, which transport them, by the aid and assistance of the wind, to very distant parts ; and others, besides this gift or convenience, are furnish'd with small hooks, that fix them to some particular spot, and enable them to withstand the wind. This is an evident display of the intention of the great author of nature ; and so likewise, it must be acknowledged,

ledged, is the wise distribution of insects eggs : But then the manner is quite different. Wherever you meet with any of the latter, you'll find them either fasten'd with a kind of glew so firmly, that 'tis impossible to displace them without breaking ; or enclosed in little cells, or lodgments, all built in various forms, but with surprising art, and secured with the utmost circumspection. From what has been offer'd we must conclude, that nature never intended an universal distribution of those eggs ; but chose rather to confine them to some particular spot.

Chev. I stand convicted. I freely renounce my comparison.

Count. I have not as yet given you an adequate idea of the difference which there is between the situation of the seeds of plants, and that of the eggs of insects. The former are waisted to and fro by every blast of wind : From whence 'tis evident, that notwithstanding they ought to be dispers'd, and scatter'd up and down, they are not to take root in all places, but there only where they find such juices as are best proportion'd to the minuteness of their pores. The case, however, is far otherwise, with regard to the eggs of insects : Nature has not furnish'd them with wings for their transportation from one place to another ; but their parents can fly where they please, and range round the fields to find out such apartments as are most commodious for them. Tho' insects, 'tis true, always swarm in a body, as soon as ever it begins to decay, yet we must not infer from thence, that they are engender'd by putrefaction, or that the eggs of such animals are every where dispers'd ; since the only true reason that can be assign'd for it is, because they have parents who are conscious that such bodies as are rotten and corrupted are preferable to any other for the support and maintenance of their young. The odour which exhales from thence to a great distance, attracts them ; nay, that odour was appointed by nature for that very purpose : And in general, the choice which the mother makes of one situation to deposite her eggs in, rather than any other for the rearing of her young, is as strong an argument, as the very organization of those young, to demonstrate,

that 'tis impossible for putrefaction to engender any being whatsoever; that nothing can possibly be the result of mere chance; but, on the contrary, that all animals, of what nature or kind soever, have their respective places, functions, and proper food assign'd them by the all-wise direction of the Supreme Being.

Prior. If chance is no ways concern'd in the disposition of those eggs, much less has she any share in their formation.

Count. No one thing in the whole creation is the result of chance. The motions, indeed, of minute animals seem capricious and accidental; but they tend as truly to one certain end, as bodies of a larger extension. The subtilty which we so much admire in a fox, for securing to himself a commodious kennel; the care and pains observable in a bird, for making herself an advantageous nest; the very same sagacity, precaution, and industry is conspicuous in a fly's choice of a proper cell, or lodgment for rearing her numerous, minute progeny. No insect whatever leaves her eggs to the direction of chance. The females never neglect them; and if their young meet with instantaneous nutriment when they burst their shells, the reason is, because the parent has wisely made choice of the happiest situation for their maintenance and support. Dissolve a grain of pepper in some water, and you shall immediately discover an infinite variety of minute worms playing in the fluid. Their dams, who know that to be the most commodious place for their subsistence, lay their eggs there, and no where else. View a drop of vinegar through a microscope, and you shall plainly discern a thousand little eels, and no other insects whatsoever: Because there is one little animal knows perfectly well that vinegar, or the matter whereof it consists, is most agreeable to the constitution of her young. She disposes of them, therefore, either on the one, or in the other, and in no other place. In those countries where silk-worms range the fields for their subsistence, their eggs are no where to be found but on the mulberry-tree. The reason for that choice is plain and obvious. The eggs of such caterpillars as feed on a willow are never to be met with on a cabbage; nor the eggs of those that eat the cabbage,

on a willow. The moth makes choice of curtains, woollen stuffs, leather, or paper, as being the fragments of cloth, for her place of residence. She is never to be found, however, either in a plant, a piece of wood, or yet in tainted meat. On the other hand, the fly lays her eggs always in the last. What is it that attracts her thither? Would not they be much more commodiously lodg'd in some china cup, that she could have recourse to at pleasure?—Experience will inform you best what it is that determines her choice.

* Put one slice of beef, just kill'd, into an open pot, and another slice into a clean pot, and cover the top with a piece of silk, so that the air may pass through it, and at the same time no fly may be able to scatter her eggs beneath it; the first slice will swarm with insects, as is the common case; because the flies had full liberty to lay their eggs upon it: The other, indeed, will moulder and decay, by the transpiration of the air, and be reduced at last, to dust, by evaporation; but then you will find there neither eggs, worms, nor flies. At most, the flies attracted thither by the odour, will swarm upon the cover, attempt to get in, but finding their endeavours vain and fruitless, will leave at last their eggs upon the silk.

Prior. From all these instances 'tis evident, that putrefaction can never be the parent of any living creature. Besides, there are some insects that have no recourse to such materials, either for the accommodation, or subsistence of their young. If, however, some *Animalcula* make choice of corrupted bodies for those purposes, 'tis no surprising thing, but as natural, as for an industrious, indigent mother of a family, and her children, to be found busy with their pickles, in a field of corn, when ripe, and fit for cutting. All nature is full of animals; some appointed for one particular food, and some for another. All have their eyes intent upon their prey, and nothing can escape their penetration.

Chev. I begin to discover more beauty and design in the conduct and œconomy of these little animals than I conceiv'd before.

Prior.

* See the Experiments of Redi, Arezzo, and Læwenhoek's Anat. & Contemp. Arcan. Nat. Tom. I.

Prior. The very same sagacity is conspicuous in the inspiration of each parent with an anxious concern for the future welfare of her progeny, and the reference of each species to the same original; that is, to a generation by eggs, or by those seeds which nature has implanted in them.

Count. Let us, in the next place, consider what this egg contains. When the female that lays it, has had no communication with the male, it is filled with a barren nutriment only, which grows dry, and soon evaporates. The fruitfulness of the egg is dependant on the male; and then there is a little worm, amidst the delicate nutriment enclosed in the shell, which though imperceptible to the naked eye, has been discover'd in a microscope, by the curious Mr. *Leeuwenhoeck*, who was one of the most celebrated natural philosophers of the last age. This diminutive worm, thus enclosed and protected by the shell, is nourished in the most tender manner, by the liquid in which it swims. Its bulk is gradually augmented, and then, being pent up too close, it bursts its shell, and finds itself, by the care and circumspection of its parent, provided with a stronger aliment, and better adapted to its new state.

Some, at the first opening of the egg, are perfect in their shape, and never lose it whilst they live. Of this sort are snails, who leave the egg with their house on their back. They will preserve the same form, and the same house; there will be some additional circles indeed to their shells, as they encrease in bulk. * Spiders are in like manner complete at first, and change nothing but their skin, as they grow large. Most insects, however, pass through a variety of transmigrations, and assume the form of two or three living creatures successively, which bear no affinity or resemblance one to another.

Cbrv. Will then a caterpillar, my Lord, become a new creature? and was a bee once in any other state than what it is at present?

Count. No doubt of it. There is an infinite variety of these minute animals that are compos'd of two or three

* *Leeuwenhoeck*, Arcan. Nat. Tom. 3. Ep. 338.

three bodies, organiz'd after a quite different manner. The second discovers itself after the first, and the third owes its existence to the second. These are so many metamorphoses. — Have you never read those of Ovid, Sir?

Chev. Yes, my Lord, and have been highly delighted with them too. They are but fables, however; unless they contain some mysterious truths which I don't rightly comprehend, and which I should be glad to have explain'd.

Count. What you say is very true, Sir. You should give no quarter to such as have explain'd those arcana. When you read them, you must use your utmost industry and application to extract from them, and from ancient history, whatever lies conceal'd, not only under some of these tales and fables, but the equivocal expressions of the ancient languages, to which no small part of them owe their rise. However, since I find you are as fond of truth as fiction, I'll lay before you a system of metamorphoses, much more surprising than that of Ovid, and at the same time true to a demonstration.

Chev. That would oblige me to the last degree.

Count. Well then! At once to gratify your curiosity and surprize you, let me tell you, there is a certain country, where a vast variety of animals are daily to be seen in different forms; some living low in the ground, others sporting in the water; which in process of time assume new shapes, live on the surface of the earth, and crawl, like serpents, through groves and meadows for a while; then eat no more, but erect themselves a dormitory, or sepulchre, where they lie for some months, and sometimes whole years together, to all outward appearance, without life or motion; and yet, at last, revive, are transform'd into birds, break thro' their prison-walls, display their radiant feathers to the sun, expand their wings, and commence gay tenants of the airy regions.

Chev. I long to know where this country lies, and what the names are of those beauteous birds. — But I can't be easily persuaded that

Count. Nothing in nature is more sure and certain. The country I am talking of is our own, and these gay
birds

birds are such insects as daily present themselves before our eyes.

Cher. What! do you mean flies and caterpillars, wasps and bees?

Count. Yes, Sir.

Cher. Pray, my Lord, what transformations do they undergo?

Count. These insects and many others, at their first issuing from the egg, are little worms, and nothing more; some with, and others without feet. The latter are left to the care and conduct of their parents, who provide, not only commodious cells, or lodgments, for them, but proper food for their support. The former look out for provision for themselves upon some tree or other, most agreeable to their natures, and the very same whereon their parents wisely plac'd them. In a short time they increase in bulk. Several of them cast off their old skins, and assume new ones; then change them again and again at certain periods. All of them afterwards (I mean all those that undergo any change) pass thro' an intermediate, or middle state, called by the naturalists, either the *Nymph*, the *Chrysalis*, the *Cone*, or *Bean*. These are several titles, or denominations, made use of to express much the same thing, and require a short explication. The minute worm, as I observ'd before, ceases to eat, encloses itself in a sort of tomb, or little monument, which varies in its form according to the species; but all of them in general are erected after a very uniform and regular manner. There, under a cover, which preserves its surprising delicacy from all insult, it is again conceiv'd, and born again. At that juncture the naturalists give it the title of a *Nymph*, that is, a *Young Bride*; because the insect then puts on its gawdiest dress, and appears in its last form, wherein nature intends it shall multiply its species by generation. This is call'd the *Chrysalis*, the *Aurelia*, or the *Golden Nymph*; because the little skin, whether hard or tender, wherewith 'tis cloth'd, is gradually dy'd with the brightest, and most lively colours. It is call'd likewise the *Cone* or *Bean*; because 'tis cover'd, for the generality, at that time, with a hard skin, like the shell of an egg, or the coat of a bean. It must be confess'd,

however,

however, that the term *Cone* is often made use of to denote those little balls of thread and glew, wherein silkworms, and some particular caterpillars, enclose themselves on their becoming *Nymphs*.

In fine, their fourth state, their grand and principal metamorphosis, is, when they arise out of their dormitories, and become flying insects; they then burst the covering that encloses them, display the plumage of their heads, expand their wings, and — But the various wonders of their resurrection shall be reserved for the subject of our conversation to-morrow. We must not trespass too far on our good friend the Chevalier. He should be allow'd a little time for his innocent recreations.

Chev. No, my Lord. I must beg the favour of you to proceed. I have seen some of these *Aurelias* in the shape of infants, drest up in swaddling-clothes, in which there have been caterpillars, as it were, entomb'd, but I took it for granted they were dead; and no-body was so kind as to give me any better information. I shall take it as a particular favour, therefore, if your Lordship will acquaint me how this transformation is accomplish'd.

Count. I'll oblige you in that particular to-morrow. In the mean time, I am pleas'd, methinks, to find you have a taste for our metamorphoses. I would fain, however, give them a new merit.

Chev. Pray what may that be, my Lord.

Count. To make them amiable. — But 'tis now time to adjourn, and they shall be reserved for the subject of our to-morrow's entertainment. I plainly perceive, my dear Chevalier, that you are concern'd at this little delay; and, I can assure you, I am not a little pleas'd to observe your impatience. There are thousands of your age who would be equally uneasy till such a conference as this was drawn to a conclusion.

DIALOGUE II.

The Count and Countess. The Prior, and the Chevalier.

Count. **M**Y Lady's company, I find, is all withdrawn; let us seat ourselves in this arbour, and resume the subject of our yesterday's conversation.

Prior. The Chevalier, my Lord, has been reading to me an abstract of our yesterday's conference, with which I don't doubt but you will be extremely delighted. He therein proves, beyond all contradiction, that were corruption capable of forming an organiz'd body, it would be possess'd both of wisdom and power. He therein likewise assigns very solid and substantial reasons for the parents choice of particular places for the disposition of their eggs; but he has been more curious than ordinary in his detail of the various transformations which insects most commonly undergo.

Count. I think we must constitute the Chevalier our secretary in ordinary. I am very sensible, that I shall find my account in that deputation. For when business prevents my attendance, I shall know, by his memoirs, the full purport of all your future conversations.

Prior. As you have acquired, my dear Chevalier, a habit of thinking well, and of clothing the thoughts of others in the most proper dress, you are a master of a very important point, and for that reason you are made from this time forward the *Fontenelle* of our academy.

Count. Where did we break off yesterday?

Chev. Your Lordship was talking of such insects as change their form to that of a *Nymph*; from thence you proceeded, by a surprising sort of resurrection, to transform them into other living creatures. Now, my Lord, I would fain know, whether they actually die before this their metamorphosis.

Prior.

Prior. * Some naturalists, Sir, maintain that they do not. For worms, caterpillars, and other insects are, according to them, no more than a kind of grave, wherein the fly, the papilio, or some other winged animal that is to rise from it, lies for a short time entomb'd. They tell us, moreover, that a caterpillar, if thrown into warm water, casts off its various skins with ease, and then the members of the butterfly enclosed, may be distinctly discover'd. However, I very much question the truth of this observation, and am apt to believe his Lordship is of the contrary opinion.

Count. We may venture safely, I think, to assert, that an insect actually dies at the time of its transformation. 'Tis a real living creature, furnish'd with every member suitable to its nature; and bears no manner of resemblance to the winged animal that is subsisted in its room. As it divests itself of its most essential parts, it must inevitably die. Take away the head and body of any other animal whatever, and you absolutely destroy it. The deprivation of the parts implies the ruin of the whole. The lion, the horse, and all other beasts and fowl, when so severely treated, die directly. As for the worm, indeed, the caterpillar, and divers other little despicable creatures, their death is the commencement of a new being; their final period, the introduction to a new order of things. The worm, when dead, produces a fly; the caterpillar, a papilio; and flying insects arise from such as creep. 'Tis granted, indeed, that there is a living embryo in the preceding animal; the prevailing humour whereof contributes by degrees to the completion of its form. 'Tis farther allow'd, that the last animal may possibly be discern'd under the skin of the preceding insect wherein it lies enclosed. The first, however, is a real animal, which actually dies to give place to the second.

Prior. 'Tis observable, that this second animal is no stranger to its predecessor; that the latter looks upon the former as part of itself, or rather, its second self, in which it is hereafter to enjoy its new state of existence. The assiduous care and industry which is so conspicuous in its erecting a monument for the ruins of the old insect,

fect, is a plain indication, that it has a distant prospect of something better and more exalted. 'Tis not startled in the least at its approaching dissolution, as being a passage only to a more agreeable state; and so far is it from entertaining any dreadful apprehensions from the sight of its winding-sheet, that it seems overjoy'd, and is assiduous in the preparation of it; nay, exhausts its whole strength and substance to bring it to perfection.

Count. Nothing, in my opinion, can illustrate this point more fully than the thread, and the various operations of the caterpillars and silk-worms. — We shall begin with the former.

Chev. I have wish'd many times that somebody would give me an adequate idea of the matter which they spin, and the form of their distaffs.

Count. Hark! — There's somebody surely listening to our discourse.

Chev. 'Tis nobody, my Lord, but the Countess behind the arbour. Let us invite her in, and make her one of our party.

Countess. As my company, Gentlemen, were all withdrawn, my curiosity led me to steal hither privately behind you. I overheard the opening of your conference, and, in short, the whole from beginning to the end; and since thread and distaffs are the topicks of your conversation, I imagine I have some right and title to a share of it, and shall make bold to take my seat accordingly. As to spinning, 'tis my peculiar province, and I shall be able, I fancy, to find your secretary employment for some time.

Chev. I shall transcribe with pleasure whatever your Ladyship shall think fit to dictate; and I doubt not but it will be agreeable to the company in general, as well as instructive to me in particular.

Countess. I thank you, Sir, for your favourable opinion of my abilities. But compliments apart, let us resume the subject from which we have digress'd.

Count. Well then! we were discoursing about caterpillars, the various species whereof (already well known to the curious) amount at least to three hundred: *

Natu-

* See Godart's Gen. Hist. of Insects, and Aubrit's Collection.

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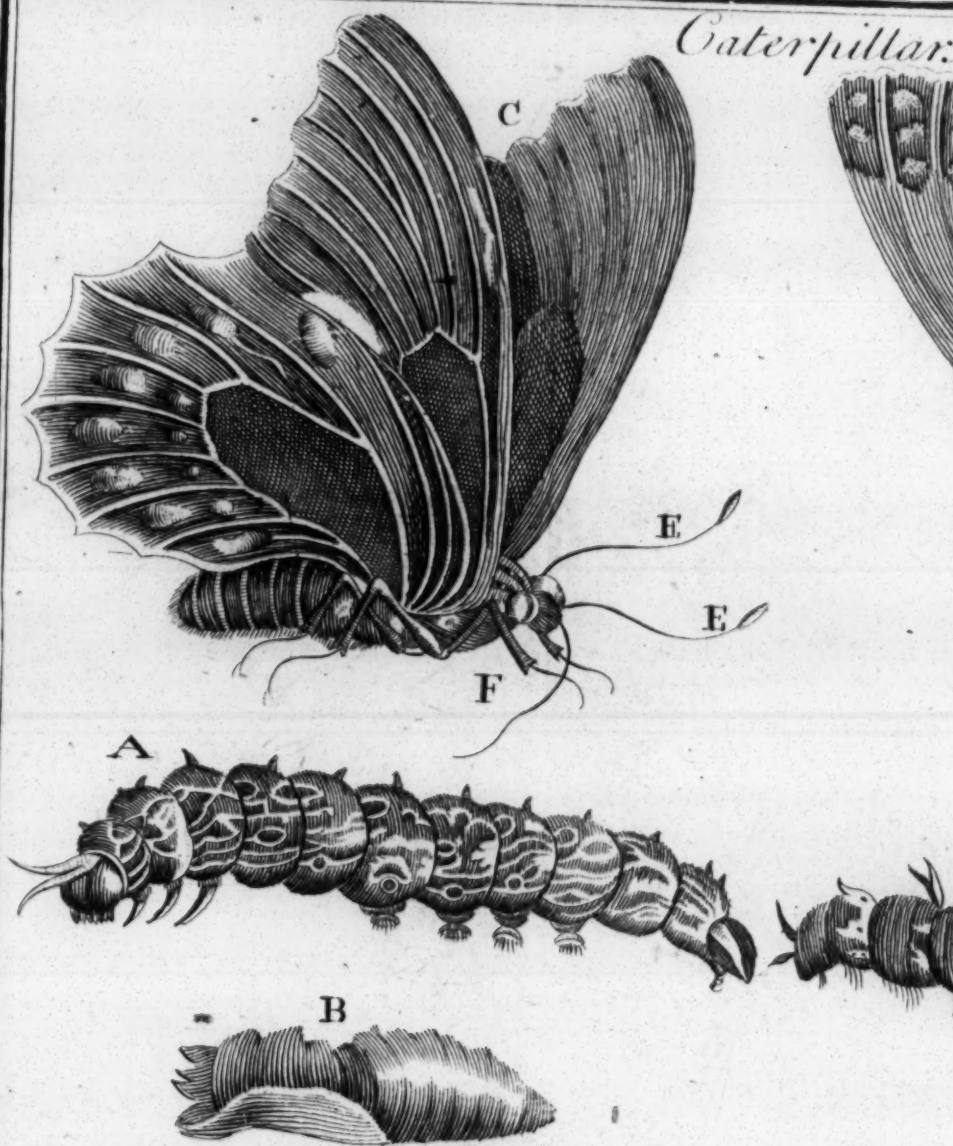
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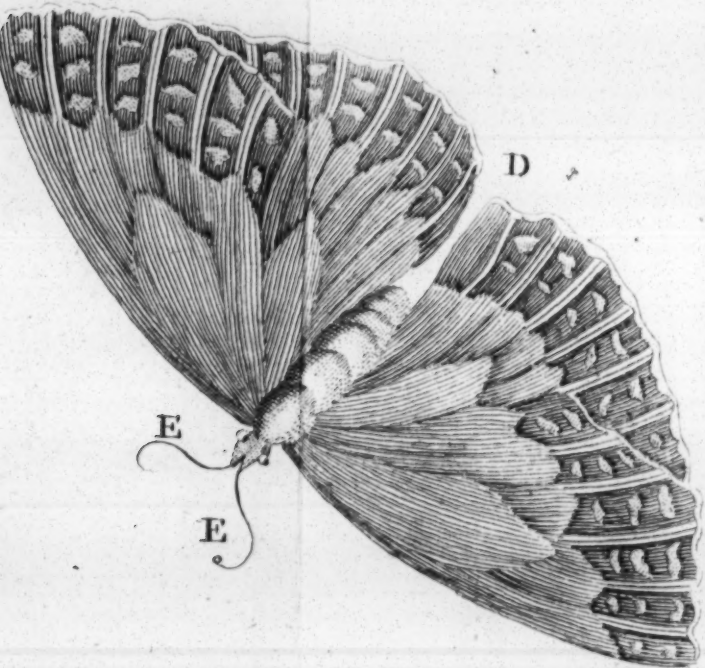
Caterpillars.



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Naturalists, however, are daily making new discoveries. Altho' one species differs from another in form, colour, inclination and diet; yet every thing is uniform in one and the same species. I shall take notice in the first place, of what they have in common. All of them are compos'd like silk-worms, of various ringlets; and by the dilatation and contraction of the parts between them, transfer themselves from one place to another as occasion requires. They have a certain number of feet both before and behind, which have several little joints that bend and play at pleasure, and nature has furnish'd them with claws, that they may fasten themselves more firmly to the bark of trees, especially whilst they are asleep. The generality of them have a thread, the substance whereof is a liquid gum which they extract from the leaves on which they subsist. If they find themselves in danger of falling a prey to some bird, or of being crush'd to pieces by the agitation of the branches, they first shed a small drop of that glutinous matter upon the tree; then, throwing themselves headlong, spin it as they descend through several little orifices of their body, from whence are form'd as many different threads, which they collect with their claws, and twist together so artfully, that having first moisten'd them with a natural glew, they form one single thread of sufficient strength to support their weight*.

Countess. Methinks I see one of our rope-makers, who, when he has once fastned his work to the wheel, retreats backwards by slow degrees, and continues throwing out divers little parcels of hemp, which mingling together, he twists with his fingers, and forms out of the whole but one single rope.

Prior. Your Ladyship's comparison is pretty just. There is some small difference, however, in the operation, which is this. The circular motion, which is communicated without ceasing to the rope, by the wheel, is that which collects several threads into one under the workman's fingers; whereas, in the operation before us, 'tis a glutinous substance that unites the various threads, by the artful direction of the caterpillar's claws.

Count.

* Leeuwenhoeck's Arcan. Nat. Tom. 3.

Count. What seems most surprizing to me in this operation is, that a fluid, which, when the caterpillar is crush'd to pieces, runs as freely as any other liquid, should be dry, tenacious, and, in a word, serve her as a strong chain to support her when she launches herself out of impending danger; and should afterwards be of service, as a ladder, to recover her former station.

This is not the only indulgence nature has shewn her, as a compensation for her weakness: She is for the most part plentifully provided with hair, which preserves her from the violence of any approaching waters, wherein she would otherwise be inevitably drown'd, burst, or congeal'd. The same hair gives her timely warning to precipitate herself at a proper distance, before she is crush'd to death by the branches in tempestuous weather; and when her thread, by being disconcerted or broken, happens to fail her, the hair with which she is cover'd over breaks her fall, and prevents her being bruise'd.

The colour of these caterpillars (tho' the Chevalier, perhaps, may think I am in jest) is one of the best preservatives that many of them enjoy from the insults of the birds, who can find no provision more agreeable, or proper for the sustenance of their young *.

Chev. I presume your Lordship means those little beautiful specks which sparkle on their backs.

Count. No; these glittering specks, on the contrary, very often discover them, especially when the enemy is near. The generality of them, however, are ting'd with one principal colour, in all respects resembling either that of the leaves whereon they subsist, or the branches on which they fasten themselves, when they cast their skins. The caterpillar that subsists on the buckthorn, is, like the plant, all over green. That which feeds on the elder, assumes the colour of the tree. There are multitudes of these animals to be found on dwarf-trees, and apple-trees that are as brown as the wood of those plants. These last very carefully quit the leaves, and trail along the branches with the utmost precaution. By these means they are confounded with what they subsist on, are not so easily discern'd, and escape the

birds that are in pursuit after them during their state of inaction.

Chev. To what purpose then, my Lord, has nature bestow'd on birds a bill to seize their prey, if that prey has a hundred ways to make its escape?

Countess. The Prior, I presume, will find a contradiction in this.

Prior. A seeming contradiction, Madam, is very evident, and reigns, indeed, throughout all nature; but then, in fact, it is a result of a sagacity which is equally apparent. This imaginary contradiction is that which keeps all nature in exercise and motion. All animals are employ'd either in attacking their enemies, or standing up in their own defence, in case of an invasion; and nature has bestow'd on each of them convenient arms, both offensive and defensive, for that purpose; and by this perpetual employment, they all find their daily subsistence, and yet there is a sufficient quantity of animals left to perpetuate the species. Tho' each class is supported, and every table daily furnish'd; yet still there are provisions in store for many days. Is there not a kind of contradiction in granting a license to our fishermen, to follow their employment, and at the same time laying them under a penal obligation, to make use of such nets as have large meshes, through which not only whole shoals of small fish, but some of considerable bulk, shall be able to make their escape? This restriction, however, is very just, and the government thereby, with great wisdom and circumspection, provides at once, not only for our present supply, but our future demands. All animals are furnish'd with nets by nature, who permits them to fish, and live by their labours; but then she has wisely appointed the dimensions of their meshes. Tho' there are thousands of fish caught every day; yet more are preserved than what are destroy'd, either by means of making their escape, or not meeting with any invasion.

Countess. You and I, Chevalier, are but weak managers of a contradiction. Suppose you start a hare, and she flies before your dog, is there any inconsistency in her conduct?

Chev. No, surely; nothing is more natural, or better design'd. Could we catch hares with only stooping to take them up, our hounds would have no manner of employment.

Count. Your observation, with respect to the hare and dog, is equally just in regard to all other animals, and insects themselves. Nature, in bestowing on some creatures a power to seize their prey, has not left the others without defence. The most minute animal has its preservatives. The caterpillars, you see, notwithstanding their extreme imbecility, are not altogether helpless. They have their little artifices, and prudent precautions. You shall oftner find them, for instance, under the leaves which they eat, than upon them, as they are by that means less visible, and more secure from the birds. They frequently practise the same stratagem as the mouse does with the cat; that is, they lie as if they were dead, amuse their enemy, make him incurious and remiss, and then embrace the first favourable opportunity to make their escape. * I have seen some of them, stretch'd at their full length, lie motionless, and seemingly asleep, whilst a thousand little winged vermin have settled upon them as their certain prey. These caterpillars have suffer'd them to ride over their backs, and then, by a sudden and unexpected wreath of their necks, have fasten'd on their enemies, and made a delicious meal of them.

Chev. How, my Lord! Are they such devourers of flesh?

Count. I have produced, you see, one instance. It must be granted, however, that this assertion is true, with respect only to some particular species. Their principal food is the leaf of some plant; nay, each distinct class of caterpillars is obliged to be contented with one particular plant; and most of them will die with hunger rather than transgress the bounds which nature has prescribed them. There are, however, some exceptions to this general rule; some caterpillars, that are regardless of this allotment, and can feed upon any thing.

Chev. Is not this strict regulation, my Lord, attended with apparent inconveniencies? Should a plant that is ordain'd

ordain'd for the sustenance of one species of caterpillars happen to fail, that species must of course fail with it. Why should they lie under such severe restrictions?

Count. You censure nature, my dear Chevalier, when you ought to thank her. Should our apple trees, which at present suffer but by one class of these insects, be over-run by two or three hundred, what would become of our deserts?

Chev. I am now convinced that nature has wisely order'd these insects not to plunder without controul. My complaint, I own, was groundless; since we reap the benefit of such restriction. I ought, indeed, rather to have ask'd, Why some species frequently multiply to that degree, as to destroy all before them? Some few years ago, that class of them which delight in the apple-tree, did not spare one single leaf. Those trees, tho' loaded with fruit, in a very short time wither'd away and died. Of what service can these insects be in general? For my part, I think we might do very well without them.

Prior. So far are they from being usefess, that were you to destroy them, you must starve the birds. Those we eat, as well as those that charm us with their melodious notes, have no other food whilst they are young. 'Tis in this their infancy that they address their cries to the Almighty, and he multiplies their food in proportion to their wants. In short, 'tis for their subsistence that worms and caterpillars are then so numerous.

Count. The infant birds, in effect, don't issue from their eggs, till the fields are cover'd with these insects: However, as soon as the former are grown strong, have occasion for other provision, or at least can live content without their first food, the latter disappear. Before the month of *April* there are neither caterpillars nor young birds, and in *July* or *August* neither the one nor the other. The ground is then strew'd with grain, and a variety of other provisions.

Prior. Till that time nature hath allotted caterpillars for the birds subsistence; and 'tis highly reasonable that the former likewise should be supplied with proper food; for which reason the plants are assign'd for their use. They have as just a right to the verdure of the earth

as we. Their title is grounded on God Almighty's original grant, and their charter is as valid as ours, since 'tis the very same.

Altho' this indulgence shewn to insects in common with man, proves frequently injurious to him; yet that misfortune was both foreseen and wisely ordain'd. Man stands not only in want of daily subsistence, but of frequent admonition. His ingratitude is confounded, when such contemptible insects rob him of what the Almighty has with such profusion open'd to his view. His pride is no less mortified, when the Lord commands his avenging armies to march abroad, and sets caterpillars, flies, and locust, in array against him, instead of lions, tygers, and other beasts of prey. The Divine Wisdom sometimes make use of such mean instruments as these, to humble the rich and mighty, and such as vainly think themselves independent, and accountable to no one. You see, my dear Chevalier, that the same Almighty Power that created the fly and the caterpillar, gave being likewise to the lion and the tyger. He has provided a suitable subsistence for them all; because he knows best for what wise purposes he created them. Every thing he has made is good in its season: And shall we, when our weak reason cannot account for the motives of his works, presume to make the least addition to, or diminution from them?—But to decline preaching, and return to our history of caterpillars; I'll beg the favour of the Count to entertain us with a view of these insects, as they are wholly employ'd in the erection of their tomb.

Countess. Gentlemen, as you expect nothing material from me, so I perceive I am ask'd no questions amongst you. But I would fain, methinks, be a member of some importance in my turn. Give me leave, therefore, to send my maid for a little cabinet out of my closet, that shall speak as pertinently for me, as an elaborate oration. You will at least find something in it that will attract the eye. Let me contribute, Gentlemen, what little I can to your amusement.

Count. Do so, my Dear. But in the mean time let me answer the Prior's request. Towards the close of the summer, and sometimes before, these caterpillars, after

after they have glutted themselves, and cast their skins several times, eat no more; but are intent on erecting a kind of monument in which they are to resign both their lives and forms, in order to be metamorphos'd afterwards into butterflies: One would imagine they were conscious of the precise time of their continuance in the state of nymphs; since their little sepulchres, with respect to the solidity of the building, are proportion'd to such duration. Those, who are to lie in that state of existence but a few days, make choice of some tender leaf, which they render still more pliant, by diffusing a kind of glew upon it. The leaf gradually curls up, and withering as it enfolds the insect, assumes its form, serves as a mantle, and a fence from the injuries of the weather, till the sun's enlivening heat and its wings enable it to break through its confinement, and fly away. Others, whose time of transformation is likewise near at hand, fasten their tails to a tree, or to the first worm-hole they meet with under a beam, or in a shelf; or else hang by a thread, or drop of glew distill'd on some vine drop, with their head downwards. They throw themselves into a sweat, which condenses, and when dry looks like scales all round about them. Sometimes they appear under the form of an embryo, wherein all the parts of the insect in due time to arise from it, lie confus'd in a consistence, which contributes, no doubt, towards the formation of it. In a word, this embryo, or chrysalis, by some small agitation, disengages the paws and wings, which were before invisible, and confined under its cover; and then the papilio, thus set at liberty, takes her flight, and ranges at pleasure round the meadows.

Such caterpillars, on the other hand, as are conscious that they shall lie several months, and, perhaps, the whole winter, in the state of nymphs, act in a quite different manner, and with much greater circumspection. Most of them agitate their bodies, till they are perfectly cover'd over with sweat; then rowl themselves on a bed of sand, the grains whereof, being gather'd into a body, become a kind of incrustation. Thus they build themselves, you see, a monument in stone, under which they wait with patience for their final transformation.

Others build in wood, which serves them in the nature of a coffin. Such as have made the leaves of willows their favourite food, break the tender twigs of them first into small pieces; then pound them, as it were, to powder; and, by virtue of their sweat, and their glutinous matter mingled together, make a kind of paste of the whole, in which they wrap themselves up; so that the paste, when crusted over them, assumes the form of a mummy, and is the mould, as it were, of the papilio that is to arise from it. I have some of them here in a little box in my pocket; and I am apt to believe the sight of them will prove, to the Chevalier at least, a novelty, and an agreeable amusement.

Chew. Beautiful figures truly! Methinks, they look like infants in swaddling-clothes. * See! this has two eyes, a Roman nose, a pair of plump cheeks, and, in short, the contours of a regular face. This, with a blooming countenance, has a beard like a philosopher; that seems to wear a crown indeed, but has a death's head underneath it.

Prior. A fruitful imagination is of singular service in matters of this nature.

Chew. 'Tis morally impossible, Sir, in my opinion, that there should be any life within, and that a butterfly should spring out of these ruins. Does not the whole appear quite dead, and an inanimate mass?

Count. Do but squeeze them a little, and you'll find some symptoms of life. I could not give you a more adequate idea of this their state of nymphs, than by shewing you these little sepulchres, from whence as many papilios are to arise. Such of them as are females, will by instinct lay their eggs on the same plant that sustain'd them, or on one of the like nature. As to the disposition of their eggs, some are laid in a direct, and some in a circular line; others again in a spiral situation round a little branch; all of them, however, are so carefully fasten'd with such a tenacious glew, that the most violent shower of rain cannot wash them away.

Some caterpillars neither imitate the mason or carpenter in their operations, but spin and weave for themselves, with surprising art, a warm mantle for the winter.

winter. We shall give you a more adequate idea of their curious works, when we come to treat of the cones of silk-worms, to which they bear a very near resemblance.

Such caterpillars as are most common, and with which we are best acquainted, are to be seen, in vast numbers, on our elms, apple-trees, and bushes. The papilio, that owes its existence to them, makes choice of some beautiful leaf, whereon she fastens her eggs in autumn, and dies soon after, stretch'd out, and glew'd on her beloved progeny. The sun, whose rays have still some influence, warms her eggs. Before winter, vast numbers of little caterpillars burst out of their prisons; and altho' they never saw their parent, yet without any plan, or previous instruction, are ambitious of excelling each other in the art of spinning, and by their industry weave themselves beds, and commodious mansions, where they shelter themselves from the cold winter blasts, in distinct apartments, without the least sustenance, and oftentimes without so much as stirring once abroad. There is only one little aperture towards the bottom of this their habitation, through which the family sometimes sally out to take the air, about noon, when the sun shines warm, and the weather is settled. When you are inclined to open these their little mansions, you must make use of some strength to break their tissue, which is as firm as parchment, and not to be injured by wind, cold, or the most rapid shower. There the whole brood lie extended at their ease on a thick down, entwin'd in divers folds of their own weaving, which supplies them with their coverlets, their curtains, and their tents.

Cher. Tho' 'tis wonderful to see these insects, which are so tender, pass the whole winter in such a manner; yet 'tis much more surprising, that they should live so long without any subsistence.

Count. There are divers species of birds, reptiles, and insects, which lie dissolved in sleep for several months together; and since there is no dissipation of their animal spirits, they stand in need of no manner of refreshment. All these drowsy caterpillars awake in spring. The first shooting of the leaves create them an appetite. They sally out in the day-time, and withdraw to their respective apartments, when night comes on, or the weather is bad.

* The most surprising species are such as have a double moulting, and are sometimes transform'd to papilios, and at others into flies. This class, according to the general notion, are to be met with on cole-worts and colly-flowers. When their work is finish'd, and they are transform'd into nymphs, as is the general case, they become butterflies. If the proper season for their transformation be casually lost, they sometimes live till the next year, then change their colour, and turn grey. Instead of rising papilios, as others do, I have observed forty or fifty little worms sally forth from the various apertures which they have made in the skin of the nymph. Each worm instantaneously employs itself in spinning a small covering of yellow thread, beginning at the bottom, and so gradually proceeding upwards in a circular line, till the work terminates in a point upon its head. After the young brood have thus enclosed themselves by their own industry, the old indulgent caterpillar likewise surrounds her spurious off-spring with a thread, which she spins herself about them; but then she seldom lives long after that operation. Such birth must doubtless be violent and irregular, and whether the caterpillar might possibly, in feeding on the bud of some plant, have swallow'd the eggs of some flies, or, more probably, some fly, perceiving the caterpillar drooping, and ready to expire, might have pierced the skin and buried her eggs there; all these *Vermicelli* soon after, without the least symptoms, or marks of the nature or constitution of the caterpillar, in whose thread they were inclosed, are transform'd into so many little flies, which are look'd upon, tho' without any just grounds, as the genuine off-spring of that caterpillar.

† The insect, generally known by the name of the *Ravenous Caterpillar*, whose principal food is the leaves of the elm, sometimes produces, after the same manner, a large fly that will join battle with the spider. I should be glad if we had two of these champions before us: I am persuaded the Chevalier would be extremely diverted with the sight of such an engagement. The intrepid fly in a moment rudely attacks the spider, who lies in ambuscade in the center of his web. Down falls the spider,

* Godart's Hist. of Insects.

† Ibid. Exper. 53.

spider, alarm'd at the shock, but spinning with all his might. The fly takes the advantage of his confusion, gives him no quarter, drags him upon the ground, and breaks his legs. After this, fired with resentment, he takes a tour round his adversary, with intent either to secure him, without running the hazard of a second engagement, or to testify the joy he conceives on the conquest gained over the implacable enemy of his whole species. When he has thus wheel'd three times round his captive, he fastens upon him, and conveys him into the air.

Chev. An intrepid hero truly! Thus did *Achilles* treat the unhappy *Hector*. After he had conquer'd and disarm'd his foe, he play'd the tyrant over him, and convey'd him to his tent.

Count. If your curiosity leads you, Sir, to be acquainted with the other classes of these insects, their warlike achievements, their various wiles and stratagems, their inclinations, and their properties, you may, during your residence here with us, make a collection of every different species in little boxes; but then you must not fail of furnishing them with a sufficient quantity of such green leaves, fresh gather'd every day, as are most agreeable to their respective natures. Make but the experiment, and you'll find, take my word for it, that their various and regular operations will prove one of the most agreeable amusements you ever met with.

Countess. The Chevalier, my Dear, seems already to fix his eyes with attention on the cones that are nearest their transformation, and to wait with impatience for their resurrection.

Prior. There is no one, sure, can view this little miracle of nature, and not be struck with admiration and delight! Do but open one of these embryos, whose transformation is near at hand, and you'll find at first nothing but a congeal'd mass, or a kind of corrupted matter, wherein every thing is confounded. In that putrefaction, however, the seed, or elements, of a most agreeable existence are implanted, which gradually transpire a cross the little skin that contains them: That skin grows redder and redder by insensible degrees, the

lineaments, which before lay confused, begin to appear distinct, and the creature at last forces its passage through the prison wherein it lay confined. The head disentangles itself, the antennæ are lengthen'd, the legs and wings extended; in a word, the butterfly takes her flight into the air, and retains no resemblance of her former state. The caterpillar that was transform'd into a nymph, and the papilio that arises from it, are two distinct animals. The first was a dull heavy creature, and only trail'd along the ground. The second is all life, activity itself, has no concern with the earth, and disdains, in some measure, to rest upon it. The first was all hairy, and sometimes of a disagreeable aspect; the other is dress'd in all the gawdy colours of the rainbow. The first, in curious, confined itself to gross provisions; the last takes a boundless range from flower to flower, lives on honey and roses, and for ever indulges himself in a variety of pleasures; in short, enjoys nature without restraint, and is one of her most favourite productions.

Countess. The Prior has given us a very lively image of our own resurrection.

Prior. All nature abounds with sensible representations of celestial things, and the sublimest truths. The advantage that flows from the study of her works is real and substantial. This system of divinity is always well received, because 'tis perfectly understood. The greatest master that ever appeared on earth, or rather our only master, recommended this method to our practice, by deducing the greatest part of his instructions from the most common objects which nature presented to his view; and he has given us, in particular, a most lively image of the resurrection in a grain of wheat, that never multiplies till it dies; but when once dead, and rotten in the earth, is perfectly lavish in its increase.

Countess. Could but one useful inference be drawn from the study of these transformations, our time would be advantageously employ'd.—But see! yonder is my maid with the cabinet I spoke of. If you please, young Gentleman, you may take the key, open my treasure, and amuse yourself as long as you think proper.

Chew. Are all these caterpillars, Madam, that are at work in it?

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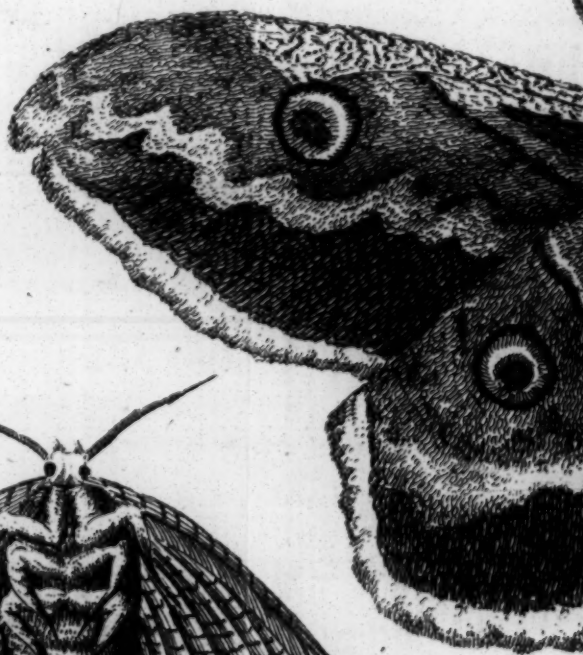
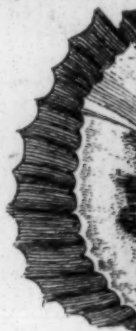
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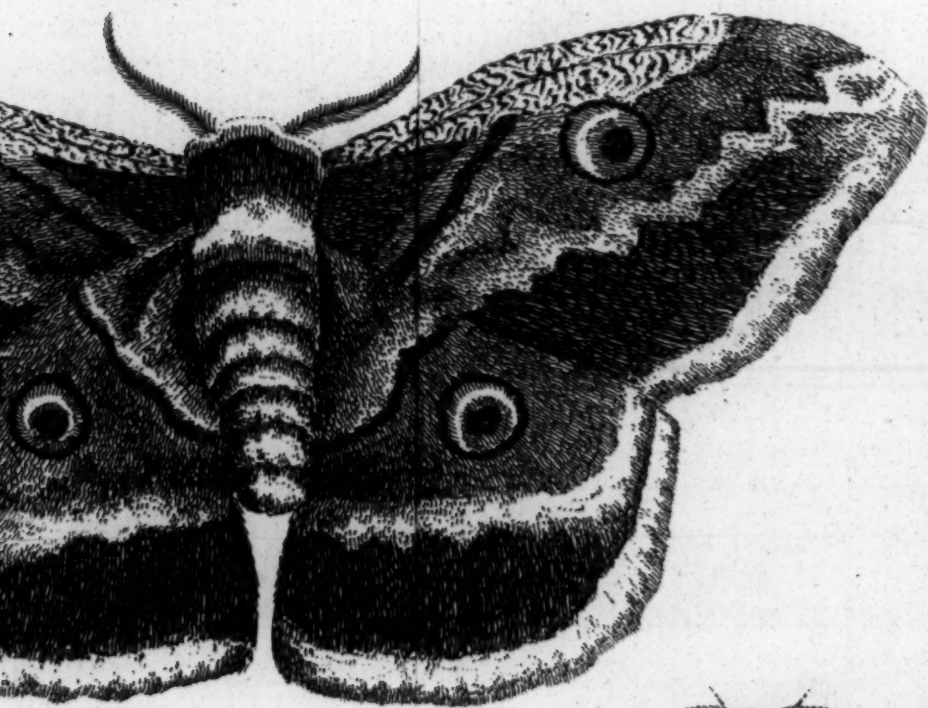
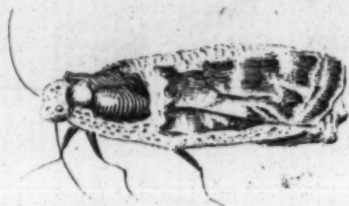


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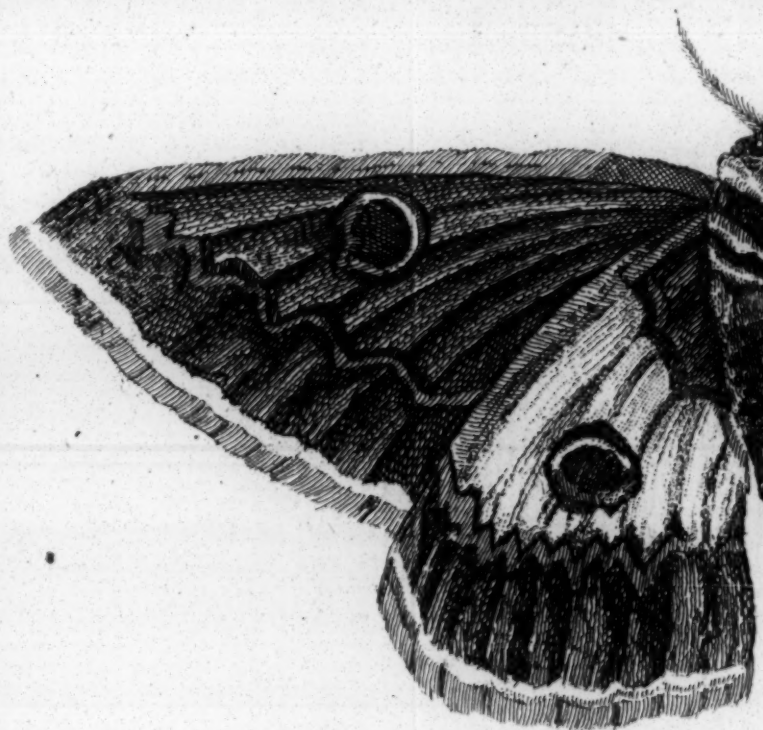
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The Papulios of the Night

page 35

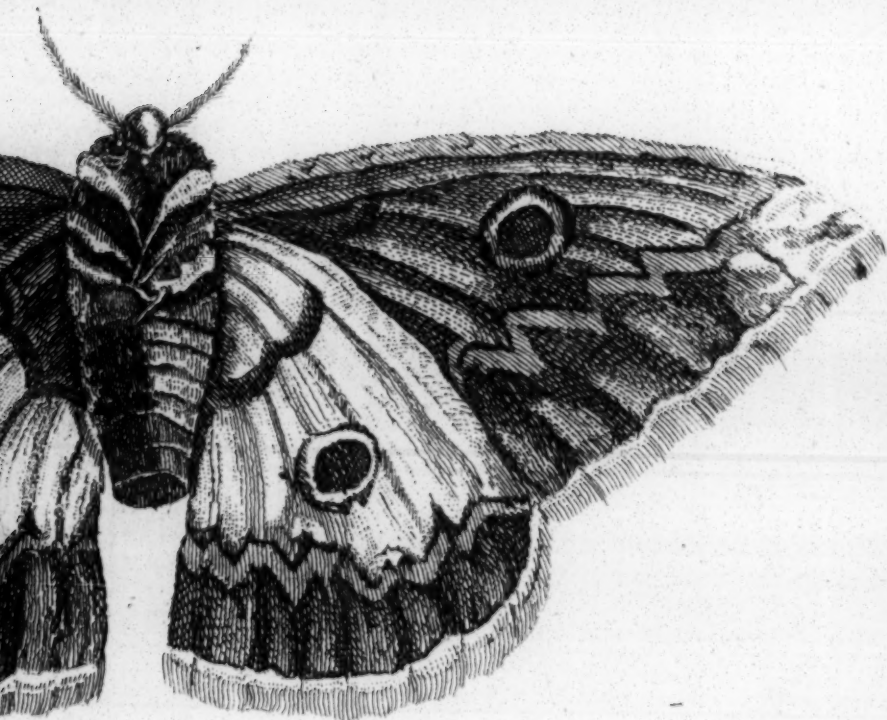


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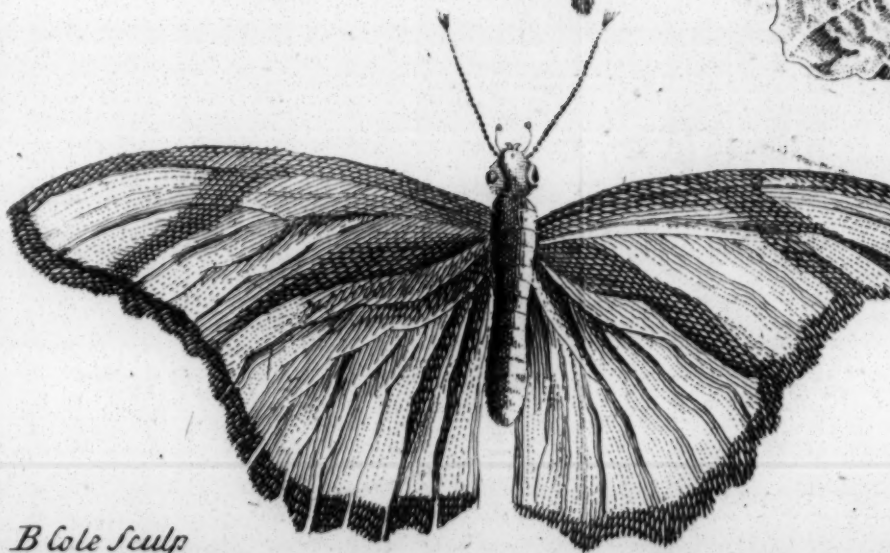
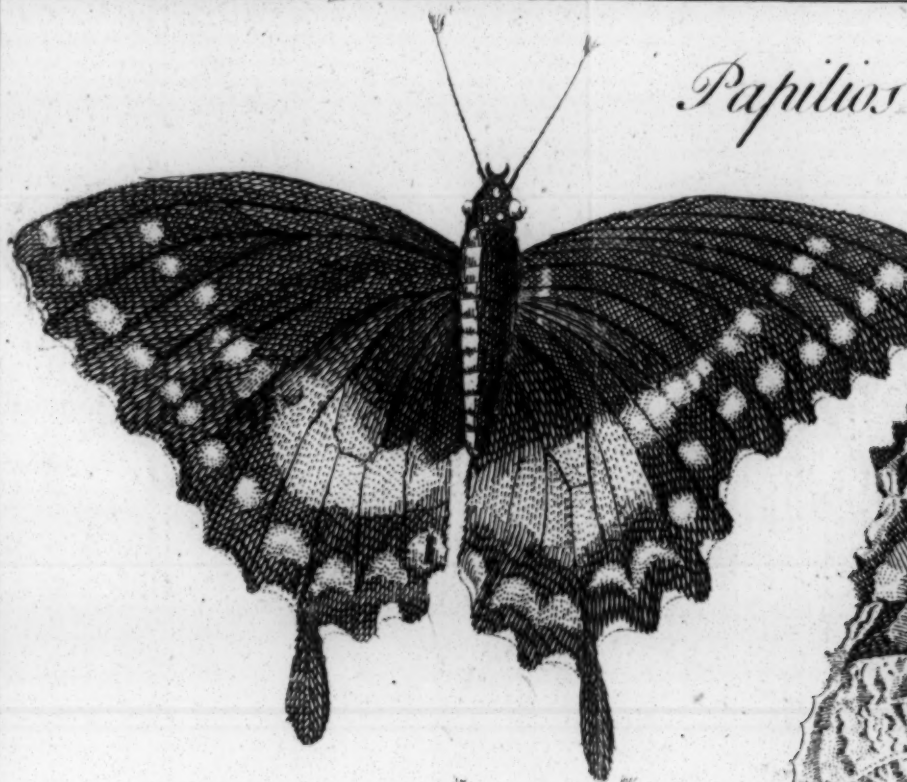


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of the Papilio's Plumage.

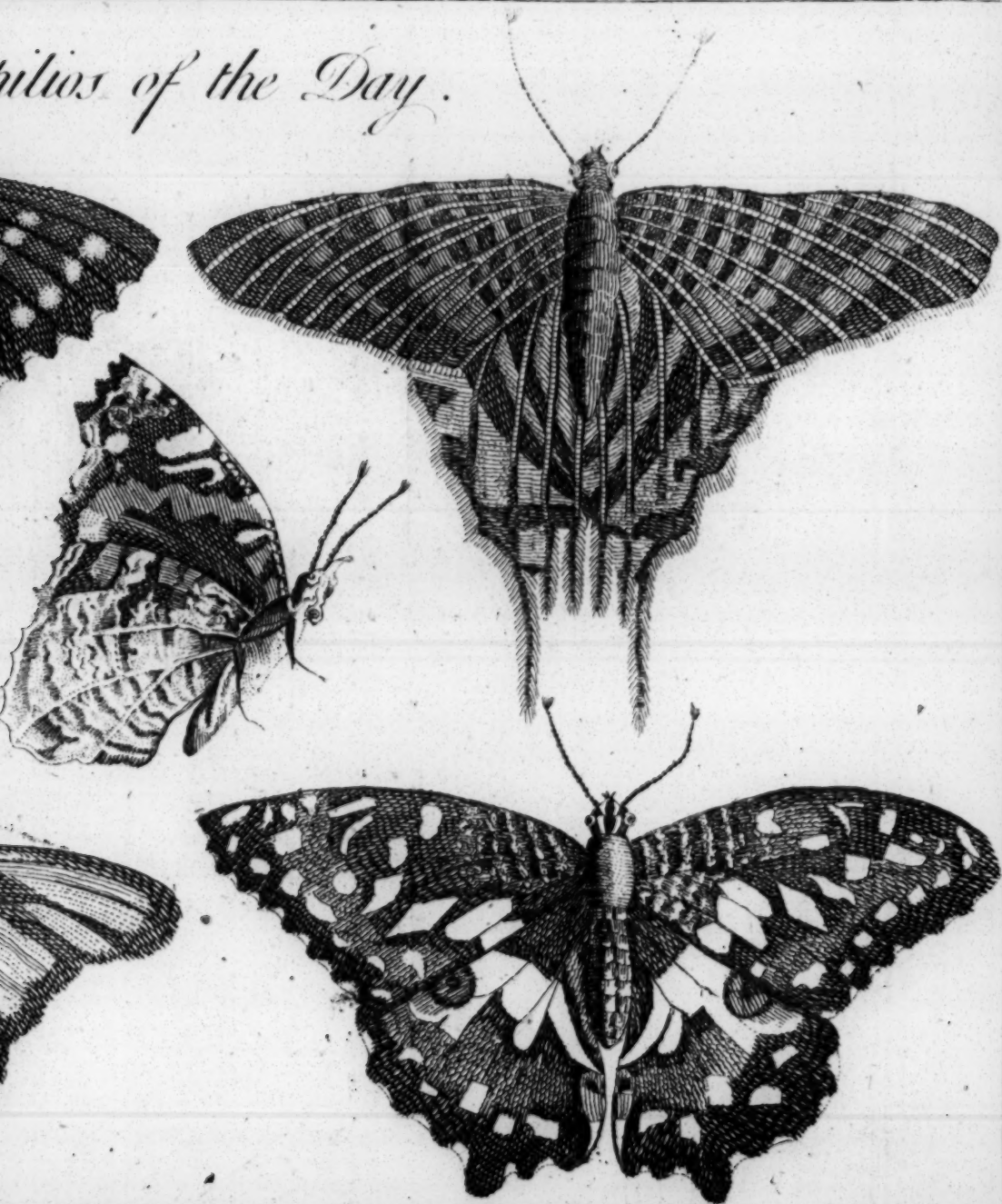


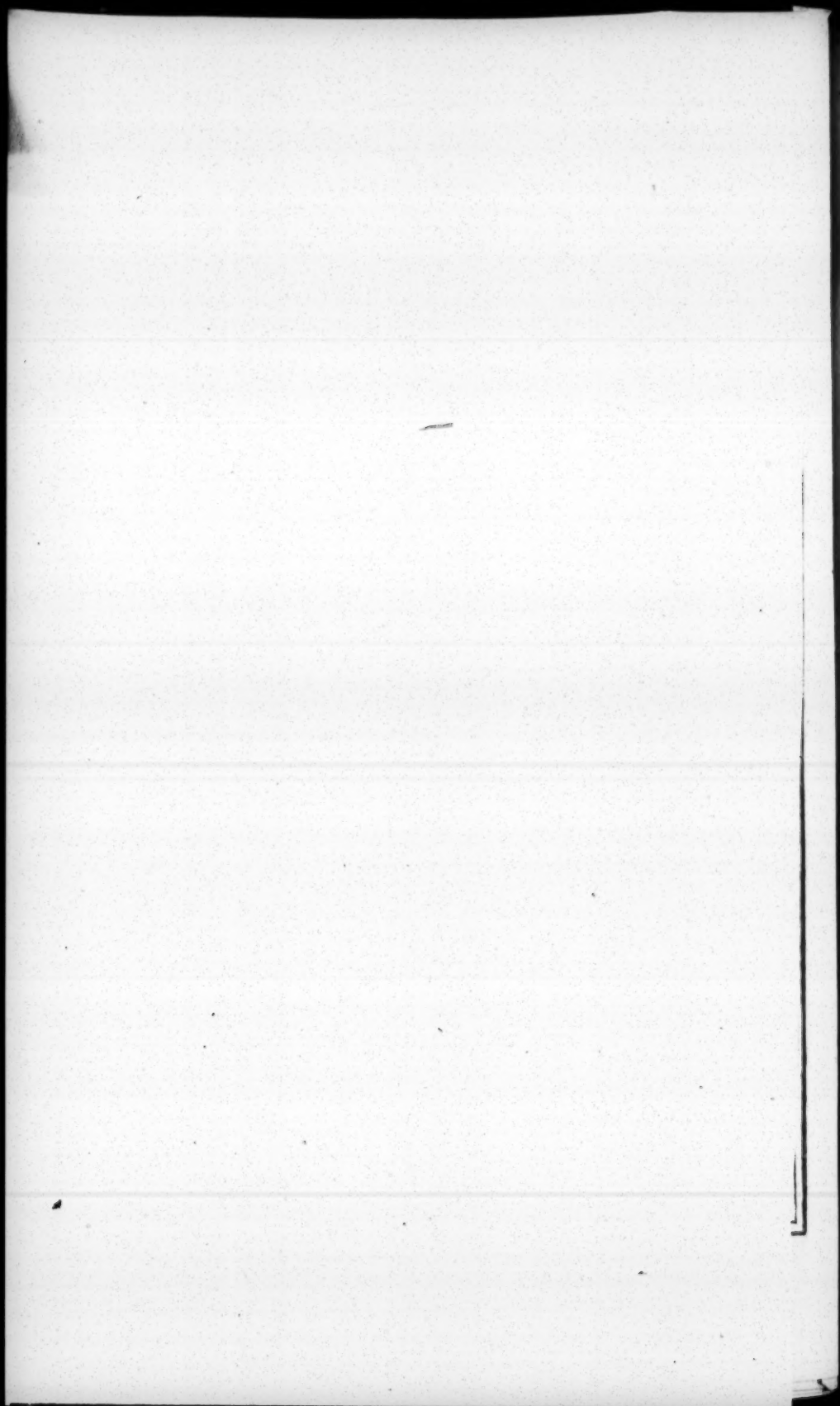
Papilio



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Butterflies of the Day.





Countess. No, Sir; they are creatures that owe their existence to, and are risen from them; but, notwithstanding their resurrection, they have no claim to immortality. I have here collected, and pasted upon distinct compartments, in this pocket-book, all the various species of butterflies that I could possibly procure. As I was instructed, when young, in the art of painting, I have not only drawn those very butterflies from nature, but the caterpillars and nymphs peculiar to each species; all as big as the life, and in their proper colours. You may take out any one of them wherever you please.

Cher. What beautiful colouring is here! Pray, Madam, oblige me with the sight of them in their proper order, and begin with the first.

Countess. You'll find I have drawn all those papilios which appear in the night upon white satin. Their colours and shades are soft and agreeable, but not glaring. A white-ground was absolutely necessary, in order to their coming out, and having a good effect. As all these flying insects make their appearance in the dark only, I have distinguish'd them under the title of my *Owl-butterflies*. Those of the first order, are the representation of moths that feed on cloths.

Cher. They lie, Madam, I perceive, in a kind of muff, from whence they not only extend their heads, but their whole bodies.

Countess. That * muff is a mansion of their own erecting. When the egg bursts which a papilio has laid upon a piece of stuff, or a piece of leather well-dress'd, and fit for her purpose, the young one finds in the nap of the one, or the hair of the other, both a sufficient subsistence, and an agreeable habitation †. It gnaws, and subsists upon them, and therewith builds the mansion, which you see there delineated with a commodious fore-door, and another to go backwards. The whole is well fastned on the ground of the stuff with divers threads, and a small quantity of glew. The moth thrusts her head one minute out of one hole, and the next out of the other, and is for ever a plundering, and eating

* Memoirs of the Academy of Sciences, 1728.

† Mr. de Reaumur,

eating up every thing round about her. 'Tis very observable, that her colour bears always a very near resemblance to the food on which she subsists. When she has clear'd all about her, she takes down all the props of her old tenement, and carries them on her back to some place adjacent, and fixes them again with some of her own little threads, upon a fresh spot of ground. If she has fed upon red wool, and afterwards finds herself situate on a green parcel, her mansion, which before was red, is somewhat larger, indeed, but of a green colour, and in all respects like the field where she finds her pasture. Thus she lives at our expence, till she nauseates her food, and then she is first transform'd to a nymph, and from that state of existence to a butterfly. Don't look now, Chevalier, on what I have advanc'd as nothing but an amusement. I can assure you, as I am mistress of a large family, a tolerable economist, and one that has a peculiar concern for the preservation of her furniture, my curiosity led me to enquire into the nature of that little pernicious animal, and in so doing, I have found out an infallible remedy to stop its progress; and that is, to rub my curtains and hangings with sheep's-wool, before it has lost its natural fatness. This specific was discover'd from the observation that the moth makes choice of such skins, and wool, as have been well-manufactur'd. There is another excellent preservative, and that is, to beat our clothes and tapestries well, before the papilios lay their eggs, and not to put them into our drawers or hang them up, till all the moths and papilios are destroy'd, either by oil of turpentine, or the smoke of tobacco.

Now, Chevalier, examine the second compartment, which begins with such papilios as appear in day-light. Their dimensions are for the most part larger, and their colours more lively. I have always taken care to paste them on a satin ground, of a quite contrary colour to that of my insects. In this and the next compartment, the colours are indeed all simple, and uniform; but in the fourth, you'll perceive them intermingled. White I have there oppos'd to red, and yellow to blue. All these colours have a good effect, and are proper contrasts, according to their different degrees.

In

In the last I have collected, and ranged, according to the best of my judgment, all such butterflies as abound with feathers, and are ting'd with the most beautiful colours. I have papillios that have been brought me from the most distant countries. Though each has a species of its own, yet 'tis of a different form. There's not one of these papilios but what has a good effect, when compared by the eye with the next to it, and the generality of them, indeed, view'd singly, and without the least dependance on the rest, strike the eye very agreeably; sometimes by the rough, and sometimes the smooth transition from one colour to another, and by the various diminutions of the tints. The largest, however, of these insects, are beautiful to the last degree. Nature seems to have been lavish, as it were, in their decoration. All the gay colours conspicuous in mother of pearl, all the radiant eyes in a peacock's tail, have not a better effect. Whenever I propose to set about a piece of needle-work, I always come here for instruction. Chevalier, You may view them as long as you think proper; but I beg the favour of you not to lay your fingers upon the papillios, lest you should rub off their feathers.

Chev. Feathers, Madam! What comes off from the wings of a butterfly appears to me to be nothing but dust. When I have had the curiosity to catch one of them, I have found my fingers cover'd over with some fine powder, of the same colour with the insect.

Countess. That powder *, as I am credibly inform'd, is a little bundle of feathers which have a quill at one end, and are rounded, and embellish'd with fringes on the other. The extremity of one covers the beginning of the next. They are fastened in the most exact order, like those of birds; and when they are rubb'd off, the wing that remains is nothing but a fine transparent skin, where the sockets, in which the quills were sunk, are plainly to be discern'd. But for your farther conviction, observe this last compartment, where I have scatter'd a large quantity of this papilio-powder upon a lay of glew.

Count.

* Læwenhoeck's *Ascan. Nat.* Tom. 3. Ep. 146.

Count. Take this microscope, Sir, and you'll instantly find your powder metamorphos'd into feathers.

Chev. Nothing can be more certain. The dust is all vanish'd, and I see nothing but a heap of the most beautiful feathers; the colours whereof are so various and lively, that the sight of them perfectly charms me.

Countess. Since I find this day's little amusements prove so satisfactory, I don't question, but my silk-worms, which I propose to shew you to morrow, will equally entertain you. My whole equipage, Sir, is at your service.

Chev. May I ask your Ladyship one question without offence? Are they any ways advantageous?

Countess. Whatever we are possess'd of that is innocent, agreeable, and inexpensive, must always be so.

SILK-WORMS.

DIALOGUE III.

The Countess, the Prior, and the Chevalier.

Countess. **T**H O' the Count, Gentlemen, is gone abroad for two or three days; yet his absence need be no interruption to our conferences. As silk-worms are to be the topick of this day's conversation, we may proceed without a fund of learning, or the help of books. I rear'd myself such a number of these insects when I was a child, that I can entertain you with a detail of their litle labours, and the advantages arising from them. The Chevalier, however, may possibly be as well acquainted with them as myself.

Chev. Tho' I have heard much talk of them, and some of my friends have bred them up in boxes; yet I was never

never indulg'd so far as to have any myself: Nay, I was never suffer'd to see those which were in the possession of other people; so that any one would be apt to conclude these minute animals had something in their nature hurtful or contagious.

Countess. Mere prejudice and prepossession! I have had silk-worms, Sir, in my house ever since I kept one. For some years past, 'tis true, I have assign'd that innocent amusement to my daughters, who feed them, keep them clean, and are co-partners in the profits. They are mightily pleas'd with their employment; for their young nursery are very agreeable creatures; and if any of them happen to fall sick, they throw them away and concern themselves no farther about them.

Cher. I should think myself highly oblig'd to your Ladyship, if you would instruct me in the art of rearing them, and the best method of making an improvement of their labours.

Countess. There are two methods, Sir. You may either let them grow up, and range at full liberty about such trees as best nourish and support them; or you may confine them at home, in some place set apart for that particular purpose; but then you must not fail to supply them with fresh leaves every morning. As the Prior has made an experiment of the former, I'll beg the favour of him to communicate his thoughts upon this subject.

Prior. My curiosity, Sir, led me some few years ago, to make use of the mulberry-trees which grew under my closet-window, for this purpose: Accordingly I lodg'd a considerable number of silk-worms upon them, that thriv'd exceedingly well, without the least interposition on my part. This is the common practice in *China*, *Tunquin*, and other hot countries. The papilios that arise from worms, or rather from such caterpillars as spin silk, make choice of the most convenient part of the mulberry-tree to lay their eggs upon; there they fasten them with a kind of glew, which the generality of insects are furnish'd with for various ends; and there they continue all the autumn and winter, without the least obstruction. And so artfully are they sometimes glew'd and dispos'd, that they are defended even from the frosts, which some-
times

times prove so hard, that they are injurious to the tree itself. The young, entrusted to the care of an indulgent Providence, never bursts its egg, till there is proper provision made for its maintenance and support; that is, till the leaves begin to shoot from their tender buds. When those leaves, indeed, are sufficiently enlarg'd, the *Vermicelli* burst their shells, and disperse themselves all over the verdure, and gradually increase in bulk, and in a few months time deposite on the same tree, several little balls of silk which look like golden apples, as they lie amidst the lively green, that adds a lustre to their beauty. This method of rearing them is the most eligible, as it contributes very much to their health and welfare, and is attended with the least trouble: The inequality, however, of our climate, exposes it to several inconveniencies, which are unavoidable. By nets, 'tis true, or some other devices of the like nature, we might preserve these insects from the insults of the birds; but the hard frosts which sometimes immediately succeed the first heats, the rains, and high winds, make a total devastation. The best way, therefore, is to rear them at home, as her Ladyship does, and I'll beg the favour of her to direct us in this particular.

Countess. * Though we make choice of an apartment situate in a good air, and open to the sun; yet we defend it as much as possible from the bleak winds, either by windows well glaz'd, or by sashes cover'd with coarse cloth: We take particular care likewise to have the walls well plaister'd, and the floors well laid; in short, to shut up all the avenues so close, that no insects, rats, or birds can ever get admission. In the middle we erect four columns, or pieces of wood, with which we form a large square; in the next place, we extend, in various ranges, several hurdles of osier twigs wattled together, from one column to the other; and under each hurdle a floor with a ledge; these we make slide in a groove, and by that means can fix, or remove them, where, and whensoever we see convenient.

When these small worms have burst their eggs, we cover the lining or paper of the box wherein they are hatch'd, with the softest mulberry-leave, which not-

with-

withstanding will contain a large number of these little creatures. When they once begin to gather strength, we distribute them upon beds of leaves, made in the several ranges of the square, erected in the middle of the apartment before-mention'd ; and leave sufficient room to pass and repass around them. They fasten themselves on the leaves, or, when they have eaten them up, on the ozier hurdles. From that instant they have a thread, by which they suspend themselves, as occasion requires, and prevent the inconvenience that may attend their fall. We supply them every morning with fresh leaves, strew'd lightly over them in a regular manner. Upon this, the silk-worms immediately forsake the old leaves, which must be constantly taken away, and carefully examin'd, lest some of the silk worms should otherwise be remov'd along with them. As therefore they require so much attendance, 'tis proper to employ some faithful and diligent servant, who will take care to supply them with their daily food, and kept them neat and clean ; for nothing is more prejudicial to these little tender animals, than a damp lodging, or any impurity whatsoever.

For the preservation of them from those distempers to which they are most expos'd, their inspectress must take particular care to gather her leaves for them in dry weather, and to lock them up in a warm closet, that she may have no occasion to dry them by a fire, and make her little nursery fast too long, which in a very little time would prove very injurious to them ; for as the lives of these little creatures are but of short duration, they improve their time as much as possible, and are for ever eating till their very last hour of moulting ; after which they continue to live about the same length of time without eating at all. Instead of mulberry-leaves, if they are difficult to be got, we give them lettuce leaves, or hollyoak. Such provision, however, is not over agreeable to them, and nothing but absolute necessity could induce them to submit to it. The silk itself, which is spun at those times, proves always of an inferior sort, and bears the visible marks of their poverty and discontent.

Tho'

Tho' the judicious choice and careful management of their diet is absolutely necessary; yet there is another precaution of equal importance; and that is, to air the chamber at such times as the sun shines warmest; and to keep as neat and clean as possible, not only the several floors laid on purpose to receive the remnants of their leaves, their ordure and other filth, but the whole apartment in general.

Cleanliness and good air contribute very much to their health and welfare. Let us now proceed to the various stages through which they pass.

The worm, at the time it bursts its egg, is a very minute creature. Its whole body is perfectly black, but its head is of a deeper sable than any other part*. Some few days afterwards, it begins to grow whitish, or of an ash-grey colour. As its skin at that time appears dirty and ruffled, it casts off, and assumes a new dress. It then grows bigger and something whiter; but inclining to a green. 'Tis observable, that at the expiration of a few days, the number whereof varies in proportion to the heat, the complexion of the creature, and the nature of its provision, it declines eating, and sleeps near two days together; then it falls into a kind of agony, and grows almost red with its violent agitations. Upon this its skin being full of wrinkles, and plaited in folds, it divests itself of that incumbrance a second time, and throws it on one side with its feet. Now it makes its appearance in a third dress, which is very beautiful, and extravagant enough, considering 'tis all accomplish'd within the compass of three weeks or a month at farthest. It then falls to eating again; and there is such a prodigious alteration in its head, colour, and in short, its whole form, that one would imagine it to be quite another creature. After this new refreshment, which continues for some days, it sinks into its old lethargic fit; and as soon as it recovers, it casts its skin again; that is a third time from the first bursting of its egg. It continues to eat for some considerable time, till at last it takes a distaste to the world, and all its vain allurements; it renounces the most exquisite dainties,

* Malpighi de Bombyc.

dainties, and shuns all manner of society: It prepares itself, in short, for a state of solitude and retirement, by erecting with its thread a little cell; the structure and beauty whereof are the just objects of our admiration. But before our little insect enters into his hermitage, let us beg the favour of the Prior, who has examin'd all these operations with the utmost care and circumspection, to give us an adequate idea of the internal arrangement of the body of a silk-worm, (from whence it deduces the substance of that fine thread with which it presents us) and of the method it observes in the pursuit of its labours. I am sensible, that you, Gentlemen, who make a constant use of your microscopes, see abundance of things very clearly, that are not to be discover'd by the naked eye.

Prior. Your Ladyship, in short, means the anatomy of a silk-worm, at which you may assist without the least indecency. This insect, like other caterpillars, is compos'd of various ringlets, which have an elastic force, and is furnish'd with a sufficient number of feet and claws, in order to fasten itself in such position as it finds most convenient. Nature has bestow'd on it a little skull, to cover the substance of the brain, which descends, and is communicated by certain vertebræ, or chine-bones, from one end of the body to the other*: Tho' there are two rows of teeth in its mouth, yet they don't work as ours do, up and down, but from the right to the left, with which it cuts and slopes the leaf on which it feeds.† The method which it observes in that operation, is this: It presses one side of the leaf, and descends obliquely, as we should cut it with a pair of scissars, from the top to the bottom†. We may perceive very distinctly the palpitation of its heart, which cannot be perform'd without proper vessels for the circulation of a fluid through the whole body. There is a kind of a little sinew, or nerve, that extends itself from the head, to the end of the tail, which we commonly call the *Spine*, or back-bone, because it encloses in the joints whereof it is compos'd, a marrow, like that of the brain. The spine, thus plac'd in the middle

* Leeuwenhoeck's Arcan. Nat. Tom. 3. Ep. 146.

† Malpighi, *ibid.*

middle of the body, and running the whole length of it, supports two other fine ligatures, or threads; not unlike a *Romish* chaplet. One of them, that is, the heart, consists in several oval vessels. The other, which is the lungs, is an assemblage of various ringlets, between which there are several orifices correspondent to those we find dispers'd all along the outward parts of the worm. 'Tis through these vents that the air gets admission to the lungs, and by its dilatation and elasticity, promotes, as we have discover'd by frequent experiments the circulation of that humour, which maintains and supports the silk-worm. If you drop a small quantity of oil on the head, back, or belly of this little creature, it will not endanger its life; but should you rub the sides of it, with oil, butter, or sewet, or any other consistent matter, those vents, through which the air is convey'd to the lungs, would be stop't up; the insect would fall into violent convulsions, and unless reliev'd by a fresh communication of the air, would inevitably die.

Between the heart and lungs, lie the ventricles and intestines, where the digestion is perform'd. All these vessels are surrounded with a vast variety of turnings and windings by a little long bag, wherein is contain'd a kind of gum of the colour of the marigold, with which the insect spins its silk.

If you were ever in the work-room of a goldsmith, or gold wire drawer, you must doubtless have seen some plates of iron, pierc'd thro' with several holes of different sizes; thro' which they draw either gold or silver wire, as fine or coarse as they see convenient. These plates which thus reduce the bar to a thread, are called wire-drawing irons. The silk-worm has much such an instrument under her mouth, with two holes, through which she distils two drops of gum from her bag. These, like two distaffs, constantly furnish the creature with materials from whence she spins her thread. These two drops are fastned where-ever she sees most convenient; and then she either draws back her head, or falls down. The gum, which distils through these two orifice, receives its form, and is extended into a double thread, which at once loses the fluidity of the liquor whereof it

is compos'd, and acquires such a consistence as is requisite for the support or covering of the silk-worm, at the proper season. This little animal is never mistaken with respect to her calculation, either of the size of those holes, or of the thickness of her thread. The strength of it is always in proportion to the weight of her body. * She unites the two threads by glewing one over another with her fore-feet; and when the proper time for making her cone is come, the claws, with which those feet are furnish'd, are employ'd either in twisting or glewing those two threads together, or in fixing her silk sometimes to one place, and sometimes to another: And I must ingeniously confess, that I have frequently stood still to observe the air and grace with which she spins; as well as the care and industry which shine conspicuous through all her operations.

Could we find out how this gum, whereof this thread is compos'd, is divided, and drawn off from the juices with which this insect is sustained, it would be a curious discovery. It must, in all probability be effected after the same manner as the filtrations and secretions of certain humours which attend a human body. I can't but think that the silk-worm is provided at the mouth of her long bag, which we have before described, with several little glands, which being from the very first incorporated with this gum, freely admit into the bag all the juices of the mulberry-leaves, that are of the same quantity, and obstruct the entrance of any thing of a different nature. As to the remainder of the aliment, one part is received, by means of the fineness, into little vessels, which convey the chyle, or nutrimental juices, to the heart: The other, which is the gross substance, finds a passage in proportion to its thickness. But I trespass on your patience, by my tedious dissertation; and I plainly perceive, that the poor Chevalier is perfectly uneasy till her Ladyship resumes the discourse.

Clara. Give me leave, Madam, to contradict the Prior for once. His conversation never gave me one moment's disquiet; and whenever his descriptions prove too intricate and abstruse for me, I extricate myself, by bringing him upon the same subject another time. But
I still

I still long, methinks, to be inform'd how silk-worms, and other caterpillars, can conceal or entwine themselves in their own thread; and how they can erect their own mansions, or places of retreat.

Countess. I have accidentally collected here three or four cones * of such silk-worms as have been something longer than usual, in the completion of their work. Here they lie in this piece of paper. We must oblige the Chevalier with a sight of them.

Chev. Ho, Madam! Are the silk-worms within?

Countess. Yes, like hermits in their cells. Let us take a pair of scissars and cut the cones open.

In the first place, observe the confused heap of bad silk that lies there, and takes up such a deal of room. Take notice, in the next place, of the good silk, artfully compacted together, and ranged with all the propriety that can be imagined. And, lastly, view with attention the cone, which consists of silk and glew, and appears like a strong stuff. Within you'll find the worm in miniature, and transform'd into a nymph. Take it in your hand, Sir.

Chev. The form of it is like a bean; there are no feet, no head, nor any other limb distinctly to be discern'd. However, there are several ringlets gradually decreasing towards the end, which are visible enough, and have some small motion when they are press'd.

Prior. 'Tis the nymph, wherein the body of the butterfly lies enclosed. The wings, the feet, the eyes, the antennæ, are all there present, but not visible. About fifteen days hence they'll all be released from their confinement.

Chev. But in case the silk-worm lies concealed beneath the down, when she spins with the utmost regularity, how can we know in what manner she accomplish'd all this work?

Countess. Nothing, Sir, is more easy. When the insect is glutted with leaves, and the time for its final transformation is actually come, it seeks out some convenient place, to erect herself a repository or cell, without any obstruction. We generally bestow upon it some

small

* The cone is a little ball of silk, in which the silk-worm wraps herself up.

small pieces of broom, or paper rolled up, wherein it retreats, and begins to wreath its little head this way and that, in order to fasten its thread on every side. Tho' all the first essays seem perfectly confused, yet they are not altogether without design. There appears, indeed, no order or contrivance in the disposal of its threads; they are not laid artfully one over another, but the worm contents itself with distending a kind of cotton, or flue, in order to shelter her from the rain; for nature having appointed them to work upon trees in open air, they never change their method, tho' brought up in a warm apartment.

When my Inclination led me to observe how they spun and disposed of their fine silk, I have interrupted some of them in their works, and taken away, time after time, their flue from them, with which they first endeavoured to make their coverings. As I weaken'd them prodigiously by such cruel treatment, and as they were quite fatigued with working to no manner of purpose, they fasten'd their threads upon the first thing that lay in their way, and then spun with all the regularity imaginable, whilst I was present; now bowing down their heads, and then raising them up again; and afterwards crossing from side to side. Altho' the motions of the worm at that time were confined within a narrow compass, yet she gradually surrounded herself with silk. What she did afterwards was not to be discern'd, but 'tis easy to form a judgment of her operations. She completed her mantle by diffusing from her long bag a gum, with which she form'd a coarser silk, and then thicken'd it with a tenacious glew, which enabled her to bind, and twist all the last ranks of this silk one over another.

Thus have I shewn you three of her coverings, and all different, which are a gradual defence and shelter for her. The flue secures her from the rain: The fine silk form a tissue, which excludes the air: The silk that was glew'd, and form'd the thick shell that touches the worm, is not only a fence against the water and the air, but keeps the bleak winds from finding any access to the inner part of her habitation. After she has retired within this solitary mansion a sufficient time to be transform'd into a nymph, by casting off her fourth skin,

skin, and from a nymph into a butterfly, by a gradual disengagement of her horns, wings, and feet, which were glew'd up, and buried, as it were, in the nymph; then is the proper time for her to make her excursion.

Chew. The task, however, is none of the easiest. Is she furnish'd with proper saws, or with a gimlet strong enough to penetrate the shell, the silk, and the down? These are all powerful obstructions.

Countess. That indulgent Providence, which directs the worm in the erection of her cell, or seat of repose, where the delicate limbs of the new animal may be found without interruption, instructs her likewise how to open a passage for her approaching flight. The cone, with respect to its form is like a pigeon's egg, and more pointed at one end than the other. After the worm has form'd that cone, by wreathing her head backwards and forwards, she always fixes it at last directly over-against the pointed end; and the reason assigned for her conduct in that particular is this: That part is not so firmly glew'd, or so exactly closed up as the others are. She knows very well, that this is to be the passage for the new animal which lies enclosed within her bowels, and takes particular care for that reason, that no substance shall lie near that pointed end, to obstruct the papilio's flight when the due season for it is arrived. When the worm has spent its whole strength in providing materials, and undergoing the fatigue of these three coverings, it dies and drops to pieces round the nymph. It is fifteen days, however, or three weeks, and sometimes more, before such nymph is transform'd into a complete butterfly. No sooner is the new-winged insect perfectly form'd, but it extends its antennæ, head, and feet, towards the point of the cone, which, not being closed up in that part, gradually gives way, and submits to its efforts. It enlarges its passage, and then makes its appearance. The tatter'd remnants of its former state lie in a confusion at the bottom of the cone, like a heap of dirty linen. I forgot to observe to you, that the papilio, before it leaves its seat of repose, discharges itself of all its superfluous humour, which was conducive, whilst in the nymph, to the forming of its limbs,

limbs, and the corroboration of them. This evacuation defiles the cone, and is a great prejudice to the silk.

Chev. What becomes of the papilio after this?

Countess. It does not wander very far from home. The male is more active and sprightly, but lesser than the female. The latter is of a larger size, because she is full of eggs. In a few days after, she deposits them in some proper place, which, in case they prove prolific, change their colour at the approach of the spring, from a yellow citron to something of a bluish cast, and after that to an ash-grey.

Chev. Now, Madam, I am impatient to know how you wind the silk off, and in what manner you make use of it. For if the papilio, before its disengagement from the cone, discharges a liquid substance that defiles it, and makes a hole quite through it, the silk must be inevitably spoiled.

Countess. You say right: There is no use, however, made of such cones as are so pierced through; besides, we take care to prevent that inconvenience. A female silk-worm will sometimes lay five or six hundred eggs; and the other cones, from whole silk we expect a future advantage to arise, are exposed to the sun, whose rays, notwithstanding all these various tissues, dart through, even to the nymph, and destroy it in less than six or seven hours, and before any damage can possibly ensue.

Prior. Now, Madam, you must instruct the Chevalier how to wind off the silk.

Countess. When we think proper to take away the silk from the cones, the first thing we remove is the down, or flue; then we throw the cones, and the silk along with them, into warm water; there we stir them about with some sprigs of broom, in order to find out the heads, or beginnings of the silk. Then we draw them through ringlets, that the cone may not rise too high, when we fix the silk to the reel, and begin to wind it. We likewise join the silk of several balls together, to a determinate number, as six; but for the generality eight, and sometimes more, according as we propose to make the silk finer or coarser. We let the cones remain in the water, till they'll yield no more

filk : Those, however, who wind it, don't wait till the whole stock of filk is exhausted, because the colour of it will change, and 'twill grow weaker as it draws to a conclusion. Though this latter filk is of an inferior fort; yet it has its beauty, and we wind it by itself. As to the cones, they are made use of on divers occasions. Some will stain them with a variety of colours, and make such artificial flowers with them, as shall strike the eye after the most agreeable manner : Others, which is the general practice, will let them lie in the water, till the glutinous matter is all dissolved; then they card it as they do wool, make a kind of silken flax of it, and work it with a spinning wheel, in order to weave it into stuffs, and sell them at a reasonable price. But for your farther information, Sir, I'll refer you to the Prior, who has a reel at home of his own invention, with which you may soon learn to wind off your filk to the best advantage.

Prior. I confess, Sir, I have such a thing; but 'twas made with no other view than to gratify the Countess's curiosity, and to let her know the exact length of the filk which these worms produced : This reel of mine, Sir, is made with four sides, each of which is three inches long. But as I have accomplish'd my experiment, I shall follow the trade no more I'll assure you.

Countess. But what do you gain, Sir, by these three inches?

Prior. The four sides together, are equal to twelve inches, or a foot. I am certain that each turn of filk on the machine, is a foot in length, or rather more; since the rounds grow larger as they fold over one another. Now, as at every turn of the handle, I wind off a foot of filk, I have nothing more to do, than to observe how often I turn the handle of the wheel, for one filk-worm, to know at the same time what is my product.

Countess. You are, doubtless, Sir, in the right. Have you ever made the experiment?

Prior. Yes, Madam, upon two cones; * and I found one produced nine hundred and twenty-four feet, and

* Bayle de Subtilit. Effluv.

the other nine hundred and thirty : But I must desire you to take notice, that the silk is double, and glew'd one upon another through its whole length, so that the total amount is near two thousand feet of thread.

Countess. We must reduce it, however, to nine hundred and thirty ; because we receive it so manufactur'd from the silk-worm. For my part, I confess, I did not expect half the quantity, and rely entirely on the exactness of your computation.

Prior. Besides this, Madam, I made another experiment ; I weigh'd my silk. The Chevalier knows very well, that a pound contains two marks, a mark eight ounces, an ounce eight drams, a dram three penny weights, a penny weight four and twenty grains ; and that a grain is a weight so inconsiderable, that the least breath of wind will displace it with ease. Now the whole nine hundred and thirty feet of silk, weigh'd no more, in the nicest ballance I could borrow, than two grains and a half.

Countess. This, I must confess, is a lesson of humiliation for me.

Prior. Why so, Madam ?

Countess. Because I pretend to be as expert a spinster as any of my sex : And yet I am now convinced, that there is no more comparison between a thread of my spinning, and that of one of these little animals, than there is between the finest twine and the largest cable. — But let us break up, Gentlemen, and take a tour in the garden. — What, pray, shall be the subject of our conversation to-morrow ?

Prior. Whatever your Ladyship shall judge most agreeable. We'll constitute you our president.

Countess. I am tempted, I can tell you, to accept of the post. — It shall not be said, however, that you admit me a member of your society merely to do me honour. I'll be strictly observant of all your laws, and propose to assist very punctually at all your conferences : Provided always, and upon this express condition, That your speculations be not too abstruse, and beyond the limits of my narrow capacity. Make as many remarks as you think proper on my poultry, and such other

domestic animals as I am well acquainted with, or on the various productions of my garden. I have a tolerable idea of all such objects as present themselves daily to my view; but I beseech you, Gentlemen, don't let me take too bold a flight.

Prior. You shall have the sole regulation, Madam, of all our subjects.

Countess. I take you at your word. We'll resume then, if you please, our former discourse of spinning. Some few days ago you oblig'd us with a detail of the labours of a spider; and if you remember, your dissertation on that topick, prov'd a very agreeable amusement. We could not have imagin'd, that such an ugly, ill-favour'd animal could be so curious an artist. This, Chevalier, I propose for your entertainment to-morrow. I would advise you, however, in the mean time, to spend a few hours with some of our country-weavers before we meet again, that you may comprehend with more ease the sequel of the Prior's discourse; for, in reality, the one will be a great assistance to your right understanding the other. They are very poor people, 'tis true, but you'll be pleas'd with their profession. Notwithstanding the invention of it may appear a novelty to you, 'tis very ancient, I can assure you. You will discover abundance of art and contrivance in it, and I don't in the least question, but you'll return me thanks for my advice, and be exceedingly delighted with what you'll see.

Chev. With your Ladyship's leave, I'll take one of your servants with me, to introduce me into their company.

Prior. That office, if you please, Sir, I'll take upon myself, in order to be your interpreter. These good people talk in a dialect which you are a perfect stranger to, and I question very much whether they'll be able to understand yours.

Countess. But before you go, take these two crowns in your pocket. Your cash, Sir, perhaps, may be short. 'Tis highly requisite that you should make them some small compensation. When you talk to them with money in your hand, you'll have no occasion, I believe, for any other interpreter.



S P I D E R S.

D I A L O G U E IV.

The Countess, the Prior, and the Chevalier.

Countess. **C**hevalier, before we enter upon the subject propos'd, I would fain know what improvement you have made of your visit to the weavers. Can you distinguish between the * Warp and the † Woof?

Chev. Yes, Madam, that I can: And moreover, through the friendly assistance of the Prior, I can tell your Ladyship the use not only of the † treadles, and (a) reeds, or stays, but of the (b) comb, (c) shuttle, and * * * * *

Countess. The Chevalier has a good memory. He can give us, I find, the distinct name of every part of the

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loom.

* The Warp is the thread which is fasten'd upon the loom.

† The Woof is a thread which passes with a shuttle cross the Warp.

† The treadles are pieces of wood, which the weaver lowers with his feet by turns, that he may raise and fall the reeds, or stays.

(a) The reeds, or stays, are several rows of threads hung upon pulles, the working whereof raises and falls, by turns, some part of the thread belonging to the warp.

(b) This implement, cross which all the threads of the warp pass, serves to bind the new thread of the stay with the preceding.

(c) The shuttle is a little implement, made of box, in the shape of a ship; in the middle whereof the weaver puts his woof, which plays backwards and forwards, through a little hole.

loom. I presume, Sir, you did not think your time ill bestowed.

Chev. I can assure you, Madam, I never met with a more agreeable entertainment. And I have a great inclination to see the various tools and implements which other mechanicks make use of, one after another. I can't conceive why they should be concealed from us. If by accident you stop to take a view of any handicraftsman's work, of what nature or kind soever, you shall soon meet with some officious persons, who shall ask you, with a very formal air, What is it, pray, that attracts your eyes so? and intimate, at the same time, that your attention is fix'd on an object that is beneath your notice.

Countess. The Chevalier's spleen is justly grounded, and highly delights me. We may set as great a value as we please, on his acquaintance with the learned languages, and his other necessary qualifications; but why, pray, should he be debarr'd from amusing himself with such employments of life as are common, and are the daily practice of his inferiors?

Prior. There would be something more, Madam, to be gain'd by it, than a mere amusement. The judgment would be cultivated by the acquisition of just ideas of all things in the most agreeable manner. The view of arts and professions, the knowledge of men, in all stations and employments of life, afford a constant source of experience, in all respects well calculated for our improvement, without either trouble or expence. We are thereby taught not only how to enrich our minds, and embellish our conversation; but to make ourselves serviceable, and of some importance on all occasions.—Her Ladyship's son, who is, doubtless, a bright genius, and most accomplish'd youth, has been train'd up in this taste. After he had been conversant, by the assistance of proper masters, with all the learned languages, and could perform all his exercises, the article of travelling was thought of as absolutely necessary. His Lordship, however, would never consent to his going into *Germany*, where he now resides, till he had spent some few hours every morning, for a whole year successively, in the study of physicks, or the most beautiful

teous parts of nature. And moreover, his afternoons were for the most part taken up in observing, and learning to some tolerable degree of perfection, the best trades or vocations, without contemning those which were the meanest and most common. He went twice, or oftner, every week, to some shop or other in *Paris*, with a firm resolution to get a competent notion of the real object, and the best method of each particular profession. He went every day, for about three weeks together, to a Gold-wire drawer, a Printer, a Watch-maker, and a Dyer. He spent near the same time with a Joiner, a Smith, and even a House-carpenter; and never left any of his masters, till he had pry'd into the secrets of his occupation. The repeated survey of the same works, the open and undisguis'd conversation of the artisans, the commendations or checks of his inspectors, the objections, precautions, and remarks of those who came to buy, made every art and profession so familiar to him, that at this juncture he knows every article belonging to trade and commerce, as well as those who make it their constant employment. He is thoroughly acquainted with the names and use of all the utensils, knows all the materials which are wrought up, and all the distant parts from whence they are transported, the private marks that denote their good or bad qualities, and their intrinsic value at first or second hand. He can distinguish the strokes of an exquisite artist, and can tell the difference between a work that is executed in a substantial manner, and in an elegant taste, and one that makes a gay appearance only, is slight, and of no real service. By these means he cannot easily be impos'd upon by the most subtle, or ill-designing workman. He never fails, however, to do justice to the performances of the most eminent masters. In a word, he is an able and experienced operator himself, and makes whatever he sees convenient with his own hands.

Countess. I allow you, Doctor, to expatiate in the commendations of my son; because you have no small share in them yourself. I am infinitely obliged to you for all your acts of indulgence towards him. I can't conceive what methods you practis'd; but whenever

your business would permit you to take a walk with the boy, you gave him a taste, not only for the liberal arts and sciences, but for all mechanical operations, in such an agreeable manner, as perfectly charmed him. Your method, as I take it, was not so much to make him a master of any particular science all at once, as to excite in him an inclination towards it. Your principal aim was to make him curious; because curiosity is a passion that can never be inactive; and this point once gain'd, all the rest follow without the least reluctance. I have taken notice a hundred times, that all your discourses, your friendly compliances, nay, your very amusements, had a natural tendency to animate him, and make him inquisitive. It was agreeable enough, for instance, to hear the curate and his young parishioner argue, as they stood by the water-side, which stones were the flattest; and then to see each of them, after they had both amassed what number they thought proper, skim their stones with a sort of emulation along the surface of the water; and when they were tired with that pastime, to observe them sit down upon the bank-side, and discourse on the descent of bodies, the level of the water, the lines of incidence and reflection, the pressure of the air, and several other topicks, which I cannot at present recollect. As soon as these conferences were over, they engaged in a new amusement with their canes, upon the first smooth bed of sand they met with; where they traced out the *Holy Land*, *Italy*, or *France*, and from thence proceeded as far as the *Indies* and *Canada*: And in case there was not sand enough for their purpose, they made use of stones, leaves, or apples, in order to stretch out a province, a mountain, or a city. In short, some new invention or other was found out every day. 'Tis impossible to tell you with what an air, and with how much pleasure my son would give me a long detail of all these operations. Every thing was so familiar to him, and so strongly imprinted on his mind, that whatever he thus learnt by way of amusement, was related to me without the least irregularity or hesitation; insomuch that the Prior, without knowing any thing of the matter, gave instruction to two at once.

Prior.

Prior. As I was his pastor, it was a duty, Madam, incumbent on me, to devote what time I could well spare to his improvement. But when we meet with such a bright genius, we cannot be too careful in the preservation of it from every impression that may give distaste. And I'll assure your Ladyship, with the utmost sincerity, that I look upon those hours which I have pass'd in little amusements with that most hopeful youth, as time duly improved, and spent to the best advantage.

Countess. The amusements of too many are perfectly trivial; and there are but very few, who know how either to give them a happy turn, or to mingle design with their recreations, and make virtue and pleasure go hand in hand together.

Chev. I must give you another instance, Madam, of the Prior's dexterity and address. After he had explain'd to me yesterday all the various parts of a loom, and informed me how to make use of them, *Well, Mr. James,* said he, to one of the workmen, *shall I take your Place? 'Tis my turn to-day.* Whereupon he immediately sat down to work, and promised to pay ten-pence for every broken thread. After that, he ask'd me, if I would venture to put the treadles and shuttle in motion, under the same forfeitures. *Yes, Sir, why not?* replied I. Whereupon he resign'd his place, and I sat down to work; but——

Countess. You spoil'd all, I suppose.

Chev. At first, indeed, things went on but very lamely; and I paid several fines, pursuant to my agreement. However, tho' it cost me some small matter of money, yet I soon improved; and grew as dextrous as another. The honest workmen were extremely delighted to observe all my miscarriages, and every thread I broke was a petty triumph.

Prior. My dear Chevalier, let's have no more talk about the Prior, or the weavers: But let us turn our discourse on a web of another contexture, which requires none of their utensils. Her Ladyship, I know, won't be offended, if I describe the spider, and her tools, before I enter upon a detail of her operations.

Countess. Proceed, Sir. You may talk of dragons and serpents, if you please: An account of the most disagreeable

agreeable objects from the Prior, is capable of giving both instruction and delight.

Prior. There are five sorts of spiders.* First, The *House-spider*, that spins her web in garrets, and such other apartments as are most neglected: Secondly, The *Garden spider*, that weaves, in the open air, a little circular web, the center whereof is her constant situation in the day-time: Thirdly, The *Black-spider*, that builds in cellars, and the ruins of old walls: Fourthly, The *Vagrant spider*, who has no settled habitation, as others have: And, Fifthly, The *Field-spider*, called the *Long-legs*.

All these spiders have something in common with each other, and something likewise peculiar to themselves. In the first place, I shall shew you wherein they all agree.

Every spider has two divisions: The fore-part, containing the head and breast, is separated from the hinder-part, or belly, either by a ligature or very slender thread. Her fore-part and fore-feet are covered with strong scales, and her hinder-part with a supple skin: The whole is clothed with hair. They have fine eyes in divers parts of their head; eight for the generality: Sometimes, however, they have but six; two before, two behind, and the rest on each side of their heads. They have no eye-lids, and are fortified with a hard, polish'd, and transparent crust. As these eyes are immoveable, nature has indulged them with so large a number, to give them information of every thing that any ways concerns them. All of them are furnish'd in the fore-part of their heads with two stings, or rather two rough branches doubly pointed, or indented like two saws, terminating with a nail, like a cat's claw. A little below the point of the nail, there is a small orifice, through which we find, by experience, that they diffuse a very strong and baneful poison. They have no other weapons so formidable as these, or so fatal to their enemies: They either open or extend these two branches, as occasion requires. When they make no use of their two nails, they let them fall down on their respective branches,

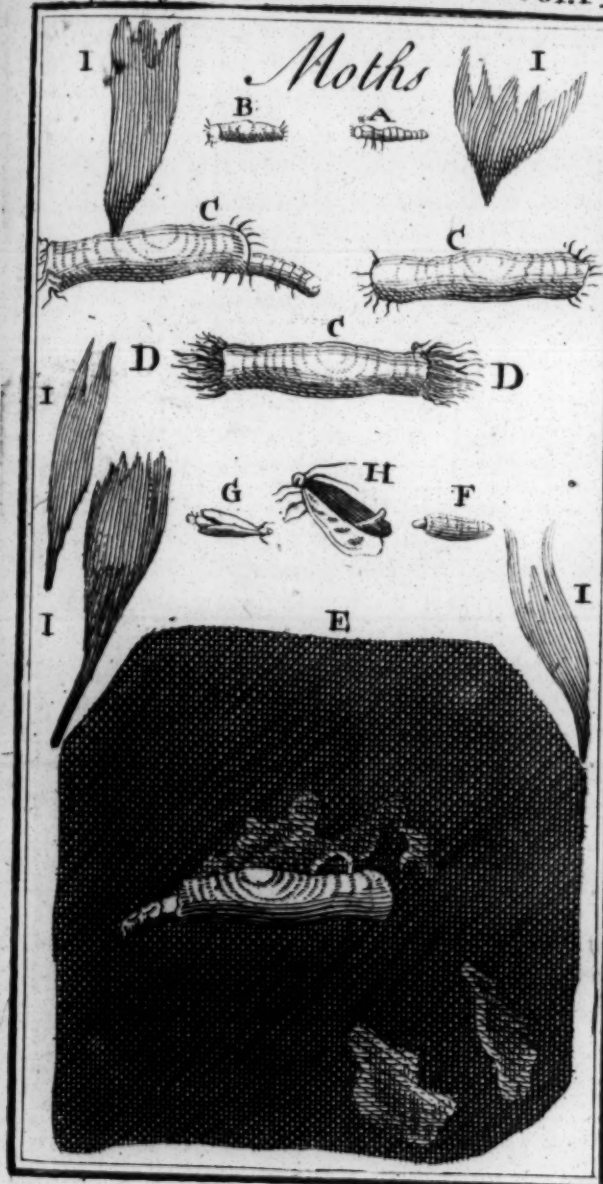
* The Memoirs of the Acad. of Sciences, M. Homberg. Loeuwenheek's Arcan. Nat. Ton. 3. Ep. 138.

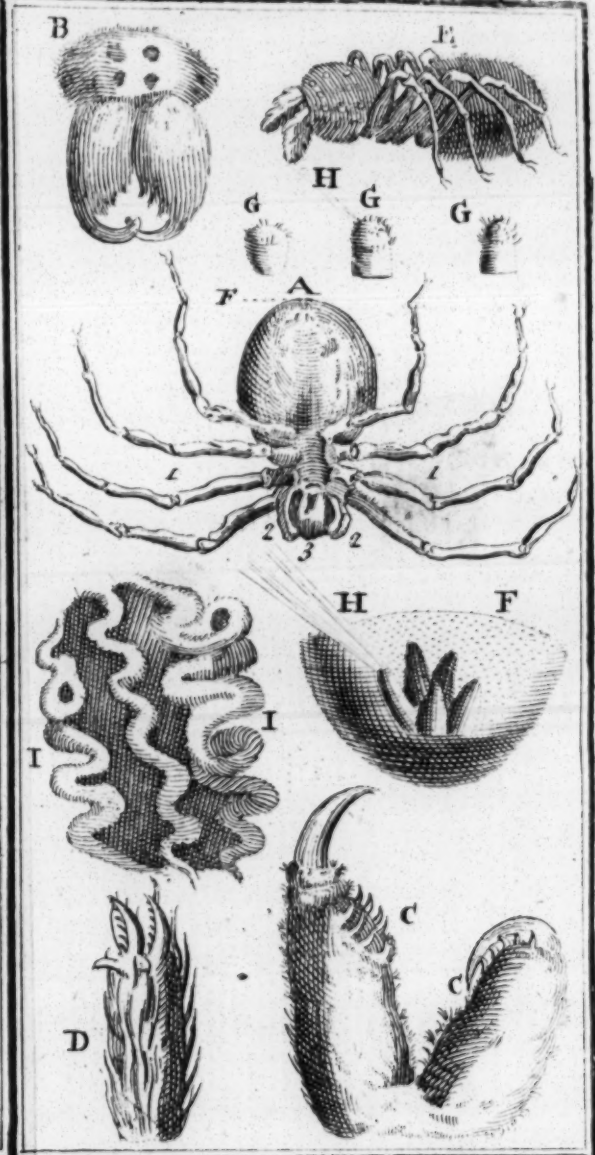
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branches, like a vine-knife clasp'd upon its haft. All of them in general have eight legs, with divers joints, like crabs-claws, and at the utmost point of these legs, three crooked moveable nails; that is to say, a small one fix'd on one side, in the nature of a spur, by the assistance of which they hold fast by their thread; and two others considerably larger, which they make use of, either to fix themselves to any one spot, as they see convenient, or to walk obliquely, or with their backs downwards, by catching at every thing that falls in their way. But when they walk upon such bodies as are perfectly smooth, for instance, on a piece of polish'd marble or a looking glass, they squeeze a little sponge, which they carry between their claws at the extremity of their feet, and from thence diffuse a glutinous matter, which enables them to stand fast, without depriving them of the power of proceeding farther. Flies have, in like manner, sponges at the extremity of their feet, and 'tis the pressure of them that occasions those little round specks, which we frequently discern in our looking-glasses, our *China*-ware, and such other bodies as are most polished. Besides the eight legs above-mentioned, these spiders have two others before, which may with propriety enough be called their arms, because they seldom make use of them on any other occasion, but to secure and hold fast their prey. The spider, tho' thus formidably equipt, would seldom prove successful in her wars, were she not equally furnish'd with other instruments to form an ambuscade. She has no wings to help her in the pursuit of her prey, as her prey has to make its escape. The disproportion therefore between them would be too great, if the spider had not a large quantity of thread in store, and was not constantly employ'd in spinning new webs, and forming new hostile devices. She spreads her snares therefore in the open air, where her prey is passing and repassing every moment: Nature directs her when she should begin to work, and that is, whilst her prey is very young; and then withdrawing, into some obscure corner behind her net, she waits with patience for her enemy, who has no apprehension of her treacherous design.

I shall

I shall now give you a description of the method she observes in the working and contriving these artificial snares, which prove so advantageous to her. All spiders have five dugs, or teats, at the extremity of their belly, cover'd over with others of a lesser size; the orifices whereof they not only open and shut, but dilate and contract, as occasion requires. Through these openings, they distil and weave that glutinous matter, of which they have an almost inexhaustible stock in their bellies. According as the insect discharges this clammy gum, through one or more of these orifices, the thread is extended in proportion to the creature's distance from the place where she first fixed it. When she contracts the orifices of these her little teats, the thread is lengthen'd out no farther, and she is suspended in the air. After this, she makes use of her thread, to ascend to her former station, by grasping it in her paws, as a sailor swarms a rope with his hands and knees. With this thread she spins herself a web, which serves her for a quite different purpose. I shall now proceed to give you an account of its use, and the arrangement of all its parts.

When a house-spider proposes to begin a web, she first makes choice of some commodious nook or corner, for a retreat under her web, and for a free passage both above and below, to facilitate her escape in case of danger. She distils on the wall one little drop of her glutinous matter, which is very tenacious. After this, she lets the liquor distil out of a less orifice. Her thread lengthens behind her, till she comes to the place to which she proposes to extend her web. The thread, as she determines to have it float in the air, is fasten'd to one of her spurs, lest it should trail along the wall. As soon as she is arrived at the point to which she purposes to extend her web, she fixes her first thread there, by the assistance of her clammy gum; then she draws it to her, bends it, and stretches it as tight as possible. Close by this she fastens another thread, which she carries forwards, running on the first like a dancer on the ropes. In the next place, she glews the second on the side of that point where she first began her work. She makes use of these two first threads, as scaffolding, to

assist

assist her in the completion of the whole. Thus she passes and repasses several times, either uniting or dividing her threads, as long as she sees convenient. After this, she binds them all, one after another, and with equal industry makes them fast. In this manner is the first range hung; and this is, if we may be allow'd the expression, the warp of the web.

Chew. I understand you; and then she'll spin her web from side to side; and that may, with equal propriety, be term'd her woof.

Prior. Your observation is just: There is one material difference, however, between the spider's web, and that of a weaver; which is this: The threads made use of by the latter length-wise, are intermingled with those that run a-crofs; whereas the threads in a spider's woof are glew'd, in crossing the threads of the warp, and not twisted, or inserted. The insect, after this operation, doubles and trebles her thread that borders her web, by opening all her dugs at once, and glewing divers threads one over another. As she is conscious of the necessity she lies under of having her web well edg'd about, lest it should be torn to pieces, she secures and fortifies the extremities thereof with strong loops, or double threads, which she fastens all round about, to prevent the wind from having any influence over it.

Chew. Such an artful piece of work is, doubtless, the just object of our admiration. But I would fain see, methinks, the structure of her lodgment, where she lies in ambuscade.

Prior. The spider is conscious of her own power; and knows well enough that were she to appear openly, her presence would strike a terror in her prey. She erects therefore, at the bottom of her web, a little cell, or kind of centry-box, where she lies concealed. The two passages, or outlets, one above, and the other below, are artfully contrived, to give her an opportunity of making her excursions, at proper seasons, of prying into every corner, and cleaning those parts which she observes to be clogg'd and encumber'd.

She removes from time to time the dust that gathers about her web, and would otherwise incommode it: For which purpose, she gives the whole a shake with
her

her paw : She weighs, however, what she does, so well, and so artfully proportions the blow, that she never disconcerts a single thread.

She has several threads, drawn from every part of her web, which terminate like rays in the center, wherein she withdraws, and waits with patience for her booty. Whenever one of these threads is touched, tho' in the gentlest manner, she perceives the motion, is apprized of her game, and springs upon it in a moment. Another advantage which she reaps from this contrivance of a cell, or retreat, behind her web, is this ; that she can feast upon her game, with all the safety imaginable, and conceal the fragments of those carcasses which she has pick'd, without exposing to publick view the least footsteps of her barbarity, which might distinguish her place of abode, or create the least jealousy in any insects that their enemy was near them.

Chev. I should be glad to know, Sir, how these spiders are always furnish'd with materials for carrying on their works ; for we find, that notwithstanding they are disconcerted, and torn to pieces one day, all the breaches are sufficiently repaired and amended by the next.

Prior. That over-ruling Providence, which well knows the spider is abhorred, that her enemies are numerous, and her labours in perpetual danger of being lost and disconcerted, has bestow'd upon her a magazine of thread, to make good such frequent waste or dilacerations ; and when that stock is exhausted, the magazine is furnish'd with fresh supplies. There is a time, however, when that reservoir will be perfectly drained. When they grow old, not only the glutinous matter in their dugs, but the sponges in their paws are quite dried up.

Chev. How then do they subsist, when so reduced ?

Prior. By their unwearied industry. An old spider, that is incapable of working for her living, makes application to a young one ; discovers ingenuously her deplorable state, and her intention : Whereupon the young one, either out of a veneration for old age, or secret dread of feeling the weight of her resentment, resigns her web without any visible reluctance, and spins herself a new one in another place. If the old one, how-

ever,

ever, can find none of her species, that, either out of fear, or indulgence, will give her admittance, she must then inevitably die for want of refreshment.

Countess. Tho' the Prior has not perfectly reconciled me to these disagreeable insects, yet he has cured me of that aversion which I once took to the very thoughts of them. Nay more, I have had the curiosity to observe, with the utmost attention, the labour of the garden spider; and as I find it quite different, and perfectly entertaining, I have an inclination to amuse the Chevalier with a description of it.

Some people imagine that she flies, when she transfers herself from one branch to another; nay, sometimes from one tree to another: 'Tis doubtless, however, a mistake; and the method she observes for the conveyance of herself to such distant places, is this: She plants herself upon the end of a branch, or some other projecting body, and there fixes her thread: After that, by the pressure of her two hind feet on her teats, she squeezes out one or more threads of two or three ells in length, which she leaves floating in the air. These threads thus exposed to the wind, are wafted from one side to the other, to some adjacent house or pole, and sometimes to a tree or post, on the other side of a brook; and by their own glutinous nature, stick and fasten there. In the next place, she pulls them tight, in order to know whether they be duly fastened or not; and when she finds them substantially glew'd, she makes use of them as a bridge to pass and repass, as often as she judges convenient. She doubles and twists the thread as much as is requisite, by joining the shortest slips together. Having so done, she walks along to the one third part, or sometimes to the middle of the same thread, and fastens another to it; by the help of which she is enabled to descend till she meets with a stone, a plant, or some other solid body whereon to rest; or otherwise, she lets it float again in the air, till she finds it fast. By the aid and assistance of this second thread, she climbs up again to the first, and, at some considerable distance, begins a third, which she fastens by the same contrivance. When three of her threads are thus fix'd, she doubles them, in order to make them stronger.

Her next business is to form a kind of square; which is no difficult task, because she climbs up, by the thread which descends on the right hand, to the first, that is extended above, and from that passes to the other, that falls down on the left. During all this progress, she never ceases her spinning. Then she shortens, and bends the last thread, which joins on the right hand, and fastens it on the left, to such place as she thinks most proper, and by that means forms a square, or something that bears a very near resemblance to it. In this square, with the same diligence and application, she erects a cross, the middle point whereof becomes a center, to which she draws several other threads, like the spokes of a wheel; which all terminate in the stock. This, Sir, is the warp, or foundation of the work: After this, she makes use of a finer thread for the woof. In the first place, she plants herself in the center, where all the threads of the warp meet, and cross each other. Round this center she makes a small circle; then begins another at some small distance, and continues without ceasing to draw this circular thread from one spoke to another, till she arrives at the principal threads, that support the whole fabrick. The toils thus spread, her next concern is how to catch her prey. She plants herself accordingly in the center of all these circles, with her head downwards; because her belly, which is join'd to a very slender neck, would fatigue her too much, were she placed in any other situation; whereas, in that posture, her paws and breast support her belly. There she waits for her prey, but not long; for the air is so full of flies and gnats, which are constantly in motion, that some of them are soon entangled in her snares. When her captive happens to prove a small fly, she dispatches it without any ceremony; 'tis a delicious morsel that requires no great preparation: But when her game is of a larger size, some intrepid fly that makes a vigorous resistance, the spider, wheeling round him, covers him all over with thread, whereby she entangles and binds him fast, and then for a time keeps him suspended in the air: After this, she conveys him to the cell, or hole beneath her web; and conceals him in the leaves, or under some tile, or in some other commodious apartment,

apartment, either to lodge in all the night, or to serve for a shelter when it rains.

Chev. But surely, Madam, this work of hers must needs be very weak; the least blast of wind must carry it quite away.

Countess. The wind is not so prejudicial to it as you imagine: This web of hers is very thin and sleezy; the wind pierces through it and seldom discomposes it. What proves most injurious to it is the rain; but as the tissue of their web is so very thin, the expence is but a trifle, since they are always provided with materials for making new snares, whenever the old ones prove defective. This, Chevalier, is all I know of garden-spiders. As to the black-spider, that builds its nest in damp cellars, or solitary caves, I hope you'll excuse me, if I can give you no particular account of it.

Prior. With her Ladyship's leave, Sir, I'll give you some idea of this hideous creature. It contents itself with dispersing her threads all round her cell, and forming one little round hole in the center for a free passage: When any insect comes near her gloomy territories, it never fails to shake one of those threads, which like so many rays are extended far and wide. The spider, alarmed at the first motion, instantly rushes out of her ambuscade. No species of these creatures are so malignant as this. If you lay hold of her by the help of two sticks, or any other implement whatsoever, you'll find she'll bite it with all the fury and resentment imaginable. This spider is likewise more impenetrable than any other, insomuch that the wasp, for instance, that by its sting and its vindictive temper, pesters so much the other spiders, gives this no manner of concern; but on the contrary, she defies its sting, and in case of an engagement, will break its bones and scales asunder with her pincers.

I shall give you but a very short and cursory account of the other two species, the vagrants and the long-legs.

There are divers sorts of the vagrants: Some are likewise of one colour, and others of another: for the generality, they run and skip; and as they are not furnish'd with thread enough to entangle their prey, when they

they have occasion for it, or more particularly, to prevent those flies from fluttering, who pester and incommoded them, nature has planted in their two fore paws, which we have made bold to call their arms, two plumes of feathers, with which they fetter the wings of their enemies, and put a stop to their agitation.

There is nothing remarkable in the field-spider, but the prodigious length and exquisite fineness of its limbs. As 'tis her lot to live amongst the smallest herbage of the field, the smallest leaf that is would stop her progress, had not nature furnish'd her with such long legs, as raise her above the common verdure, and enable her to rush directly on her prey, when she sees it before her.

But as I don't think a bare description of these various kinds of spiders a sufficient amusement for you, I shall proceed to inform you how they lay their eggs, and preserve their species *. There are several people so squeamish, as that they'll eat no kind of fruit, because they imagine that the spiders and other insects have laid their eggs promiscuously upon it; but this is mere affectation, without any just grounds of fear to support it: They are more curious and careful in the disposition of their eggs, than the generality of people imagine. So far are they from dropping them at random, that they spin a web four or five times stronger than those which they make for their toils or snares, as a particular lodgment for them. 'Tis a web they spin with the utmost satisfaction: and, in short, with the best materials they can possibly procure. With this they form a bag wherein they deposite their eggs; and 'tis almost incredible to relate the concern and industry which they bestow in the preservation of it.

Chev. This bag of your's makes me laugh, Sir, very heartily: But can't you oblige me with the sight of one?

Prior. 'Tis very commendable not to be too credulous. We'll walk, therefore, if her Ladyship thinks fit, for a few moments by the box-trees which border this terrass. I have been searching, my dear Chevalier, before-hand, and have found the thing which you want to see.

* Memoirs of the Acad. of Sciences, M. de Reaumur, 1710.

see. Observe, Sir, in that tree, one of those spiders, who never spin a regular thread as others do. You see she carries a large white ball under her, which perhaps you may imagine to be a part of her belly.

Chev. And is it not really so, Sir?

Prior. No, Sir, no. Take but a little stick, and shake the spider a little, and you'll find she will drop her ball.

Chev. 'Tis fallen, indeed: With what concern she runs after it!

Prior. This is the bag of eggs you wanted to see. Don't think the dam will abandon her treasure. Take notice, Sir, of her conduct in this particular.

Chev. I perceive she throws herself over the ball.

Prior. That is not all, Sir. She squeezes out of her dugs a glutinous matter, with which she fastens herself to the ball again.

Chev. 'Tis very true; and see! she carries it away with her.

Prior. Her regard for it does not end there. She expresses her tenderness and affection for her young a thousand other ways besides. You may form some idea of it from the behaviour of this other spider, that is of the same species, and whose young ones are just hatch'd.

Chev. Where are the brood? For my part, I can see none but the old one.

Prior. Pray, Sir, look with attention on her back.

Chev. I can discover nothing more than a small prominence.

Prior. Move, but as gently as you please, one of those threads you see scatter'd about that little aperture there; and observe the little fry that will sally out of the back of the spider.

Chev. This is an agreeable amusement, indeed! Methinks I see above a thousand little spiders hurrying away from their dam, and running along these threads. Does the old one carry her whole family upon her back? Pray, Sir, what will become of them after this fright?

Prior. Have but a little patience, and you shall see the whole clan, when they imagine this danger over, return to their quarters.

Chev.

Chev. I protest 'tis very true. They are all gathered together again in a heap upon their mother's shoulders.

Prior. Now, Sir, observe this spider, which is of another species; who deposits her eggs in a little purse, much like a leathern cap, which she either fastens on a wall, or a leaf, as this has done before us. She never takes her eyes once off from her invaluable treasure; but watches it incessantly day and night. She hatches and warms her eggs, by hovering for ever over them. Pluck off the leaf, and see what will become of the old one.

Chev. She will not run away, I perceive; but comes along with it. To tell you true, I an't over fond of her company.

Prior. She'll suffer death before she'll abandon her young: She'll hold fast, you'll find, till the little brood are all hatch'd. Tell me, Chevalier, what do you see in that other aperture?

Chev. I can discern two little bags, or balls of a reddish colour, which hang by several threads; and before them I perceive a whisp of dry leaves. For what purpose are these things planted there? Are they not drove there accidentally by the wind?

Prior. A spider of another species has hung up those two bags, and treasur'd up her eggs there.

Chev. But of what service can that bunch of dry leaves be, that swings about in the very passage?

Prior. 'Tis planted there with design, as a blind to travellers; such as wasps and birds, who lie in wait for her eggs. This little parcel of dry leaves is no temptation to the birds; and by the perpetual agitation of it, they are prevented from discerning the little bags, which lie concealed behind it.

Chev. Success attend, I say, such great examples of unwearied industry!

Prior. We shall not give ourselves the trouble of hunting for a spider of the common sort, in order to give you a view of her method of working. It will be sufficient to inform you, after what you have seen already, that all spiders in general deposit their eggs in webs of a surprizing strength. Their packet is for the
generality

generality fasten'd to a wall. On the least apprehension of danger, their first concern is to pull down this packet; and when that is secur'd, they fly for safety where they can. Thus, my dear Chevalier, have I given you the best account I can; and indeed, all the observations that I have made on the conduct and œconomy of these spiders.

Countess. But, Sir, you have forgot, in all your discourse, to mention the *Tarantula*. I shall therefore endeavour to give the Chevalier a transient idea of it, as being an animal of too curious a nature, to be entirely neglected. This insect, as to its form, bears a very near resemblance to the house-spider; but the bite of it, especially in some hot countries, is attended with very fatal and surprizing consequences. The poison is not immediately discern'd, because the quantity of it is too small; but then it * ferments; and in four or five months time, the frightful disorders which it creates break out, and baffle the art of the most able physician. The person infected does nothing but laugh and jump about; he dances and wreathes himself like a madman, into a thousand antic postures; or else, is cast down, and affected with all the symptoms of the blackest despair. At the return of that period of the summer-season, when the wound was receiv'd, the fit returns; the patient talks as wild as before; he imagines himself a king, a shepherd, or what else you please, without the least ray of reason. These frightful symptoms are sometimes repeated several years successively, and end at last in death. Some gentlemen, who have travell'd into *Italy*, and particularly round about † *Naples*, inform us, that this unaccountable distemper is cur'd by a specifick equally fantastical. Musick alone will give the patient relief; and an agreeable sprightly instrument, such as a violin, has, it seems, the surest and most speedy effect. This is the favourite instrument of that place; and the musician endeavours to hit on such notes, as bear the nearest affinity to the temper and disposition of the patient: He makes several essays accordingly; and if he happens to touch a note that makes any impression on

* *Memoirs of the Academy of Sciences, 1703.*

† *Misson's Voyages into Italy.*

on the person affected, the cure is infallibly perform'd. The patient instantly begins to dance; he sinks and rises according to the tune. By this violent exercise he throws himself into a sweat; the poison that torments him evaporates, and he feels the fatal effects of it no more. This account I received from a friend, who was some time since consul at *Naples*, where, as he inform'd me, he had seen several persons that had been bitten, and cur'd by the magic, as it were, of melodious sounds.

Chev. Learning, I find, shines conspicuous through all this family. Every new narrative has something in it, not only very marvellous, but extremely entertaining.

Countess. If the account I have now given you appears so surprizing, you'll doubtless pronounce me very learned, indeed, when I come to expatiate on my chickens, and my turky-powts. That topick, Sir, shall be discus'd in its turn.—But see! his Lordship is now alighting from his horse, and has brought a great deal of company with him. Let us go and welcome him home.

Chev. I fly to embrace him.

W A S P S.

DIALOGUE V.

The Prior, and the Chevalier.

Prior. **T**HE Company, Sir, that came here yesterday, having some affairs of importance to dispatch before they go, neither the Count nor his Lady can possibly wait on you to-day. I shall make you but a poor

poor compensation, I am afraid, for that loss. However, I have a piece of news to acquaint you with, that may possibly prove an agreeable amusement.

Chev. Pray, Sir, what may that be?

Prior. Not far off, Sir, there has been something discover'd under-ground, that will demand your most serious attention.

Chev. Can one see it?

Prior. Yes, Sir, whenever you please. The affair in short is this. His Lordship desired me to entertain you this afternoon with the various transformations which flies of every species undergo. I spent some hours yesterday in collecting what I thought most curious on the subject, and was throwing my observations into some little method, when a messenger came to inform me, that some labourers, who were digging here hard by, had met with a piece of work that excited the curiosity of thousands to go and see it. Upon this, I immediately laid aside my papers, and went with the crowd to take a survey of it; and I must needs own, I didn't think my labour lost; for they had discover'd a whole city, that lay buried in the earth, a city large enough for the reception of near twelve thousand inhabitants; the structure whereof appears very artful, tho' very different from the present mode. The wall is not merely an inclosure, but rather a kind of dome, that covers and encompasses it round about. The persons who gave me this information, having taken an exact survey of it, could find but two gates; and as it was very dark within, their curiosity induced them to demolish some part of the works, that they might have a clearer prospect of the whole; and to their no small surprise, they observed that the streets were not ranged in side-lines, like ours, but in different stories, one over another, divided by several rows of pillars; insomuch, that they are, properly speaking, rather porticoes than streets; the uppermost of which is supported by the second, the second by the third, and so in succession downwards. The houses are all of one dimension, and built close to one another, in the thickest part of the vault; all of one order, and level in each story; all cover'd with a flat terrass, composed of a tenacious gum,

gum, and as smooth as a marble pavement. The inhabitants take their walks here between the pillars which support another vault, and another row of houses. There are eleven of these vaults, or porticoes, which are all built with the utmost beauty, regularity, and design. The only objection to the work is the obscurity of it. There is no sign of a lanthorn, or any thing of the like nature, to be seen for the illumination of it.

Chew. This was a very uncomfortable place, sure, to live in.

Prior. Perhaps you may imagine I have been describing some city which was built before the flood, and sunk afterwards into the earth.

Chew. Indeed, Sir, I can't tell what to think.

Prior. Tho' not so, yet 'tis something very surprising. In short, this city was erected only by a swarm of wasps.

Chew. How, Sir! and is that all?

Prior. That all, quoth a!——Had this city been built by the ablest workmen, there would be no room to find fault with the architecture of it: But 'tis a most marvellous thing that a large dome, with proper pillars and porticoes; in short, that a whole city should be erected by a community of wasps.

Chew. Let us have a sight of this curious fabrick then. 'Twill be an agreeable amusement.

Prior. 'Tis in the summer-house. I imagined it might prove a more agreeable entertainment to you than a formal dissertation upon insects. I have preserved it as whole as possibly I could. There is only a small fraction in one of the sides, to give you an opportunity of seeing what's within. Step in and look at it. You'll find the whole city upon one of the benches.

Chew. What a beautiful piece of work is here! Every thing answers exactly to your description. Here are pillars, stories, houses, and domes. But pray, Sir, how came you by this nest, and where was it found?

Prior. I plainly perceived the number of my bees and my stock of honey considerably diminish'd, and suspected that some wasps nest near my garden was the source of this fatal disaster. Accordingly I gave orders that, in case it could be found, it should instantly be destroyed.

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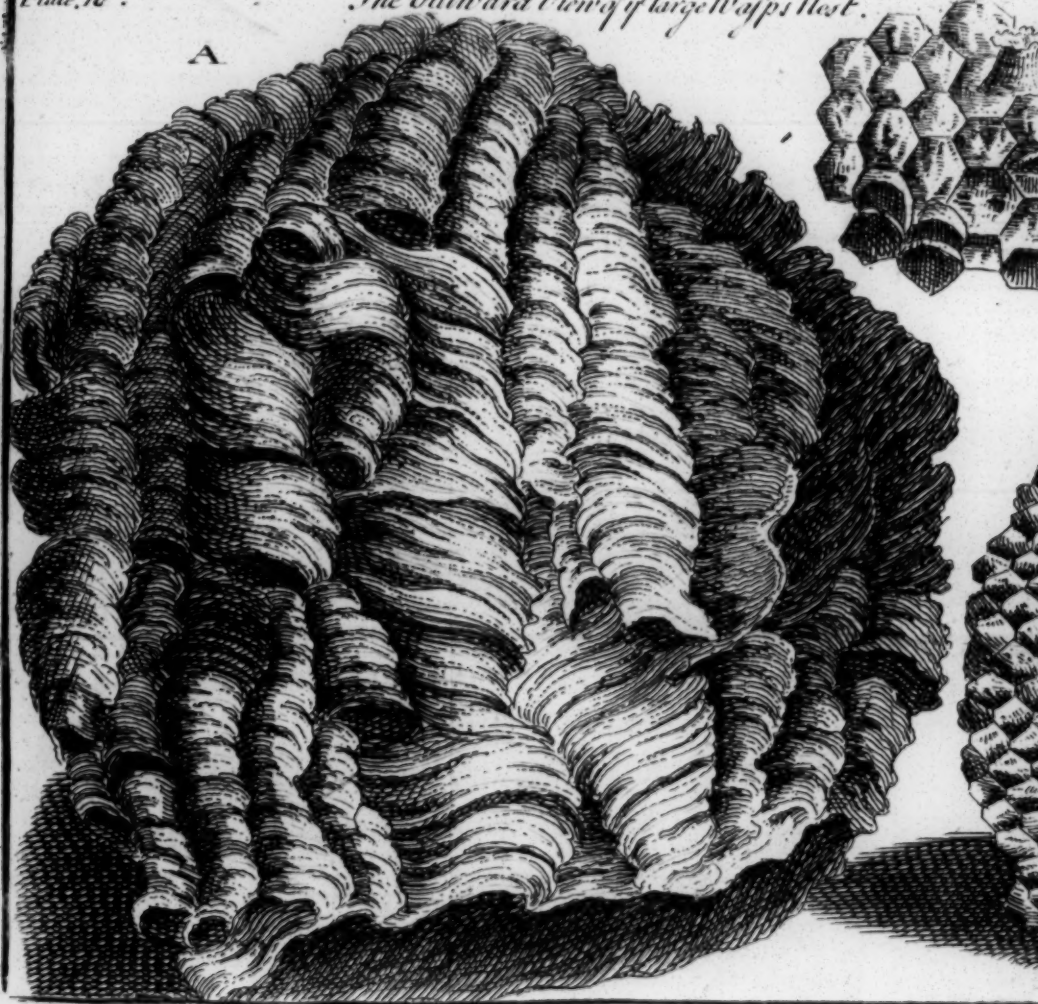
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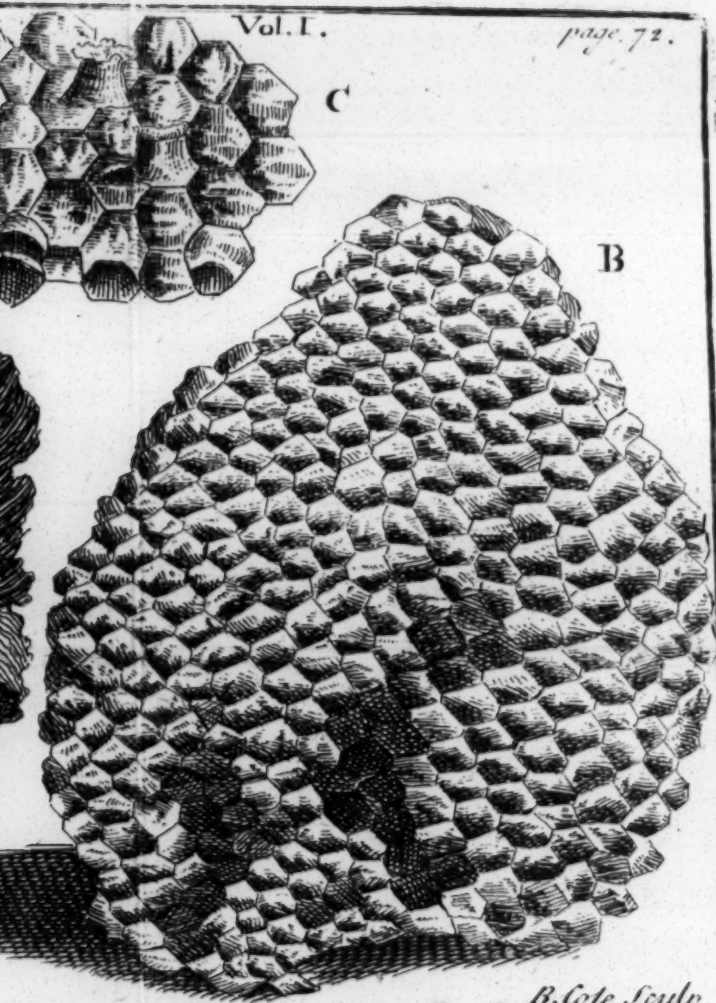
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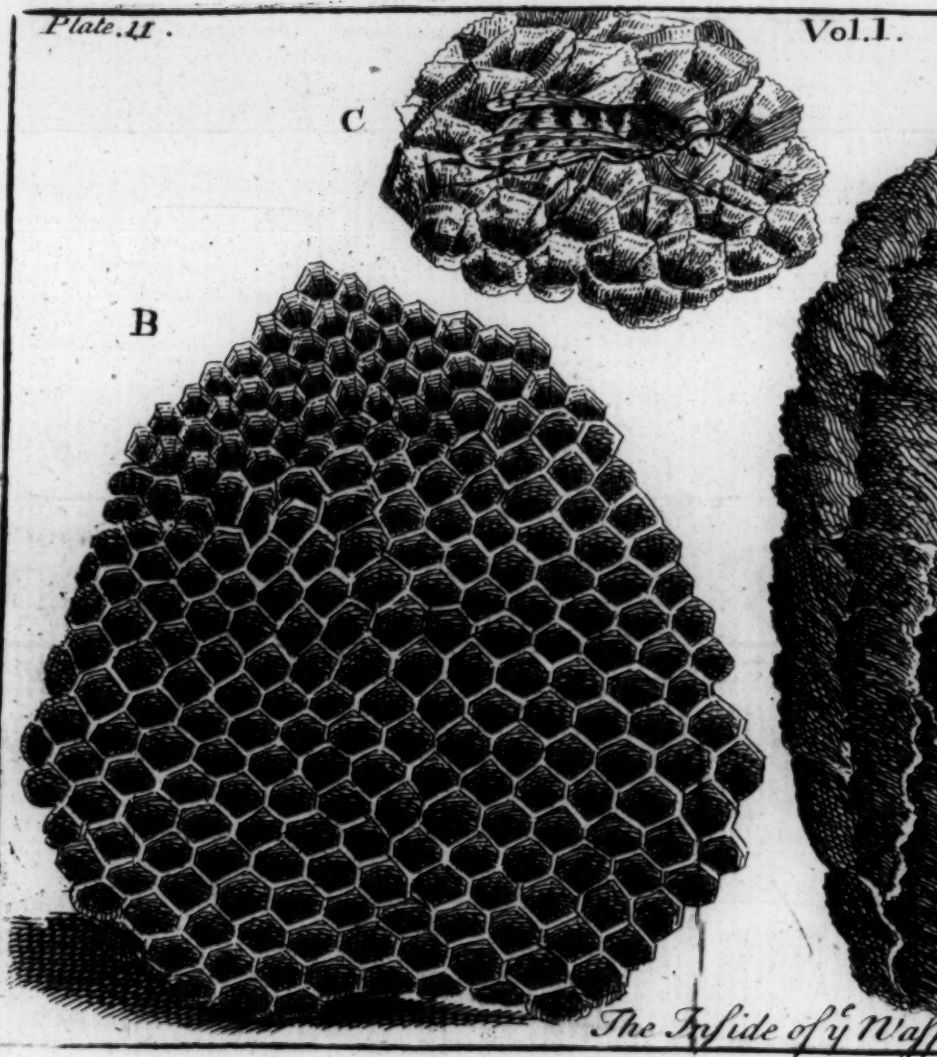
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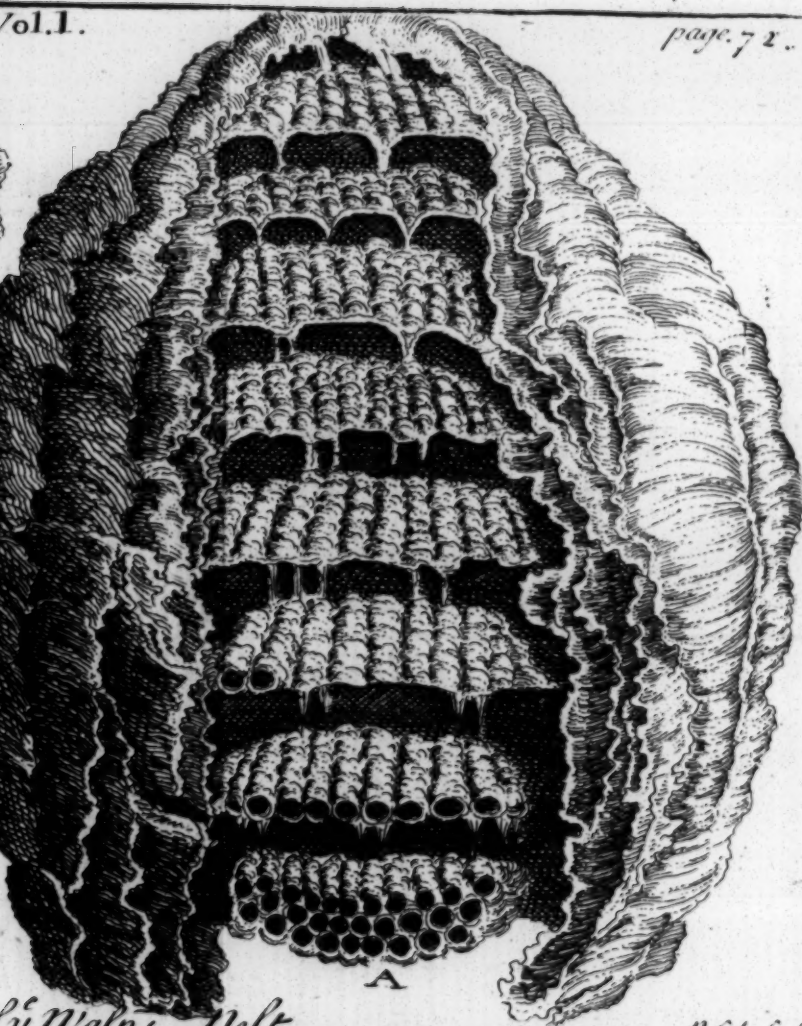




B. Cole, Sculp.

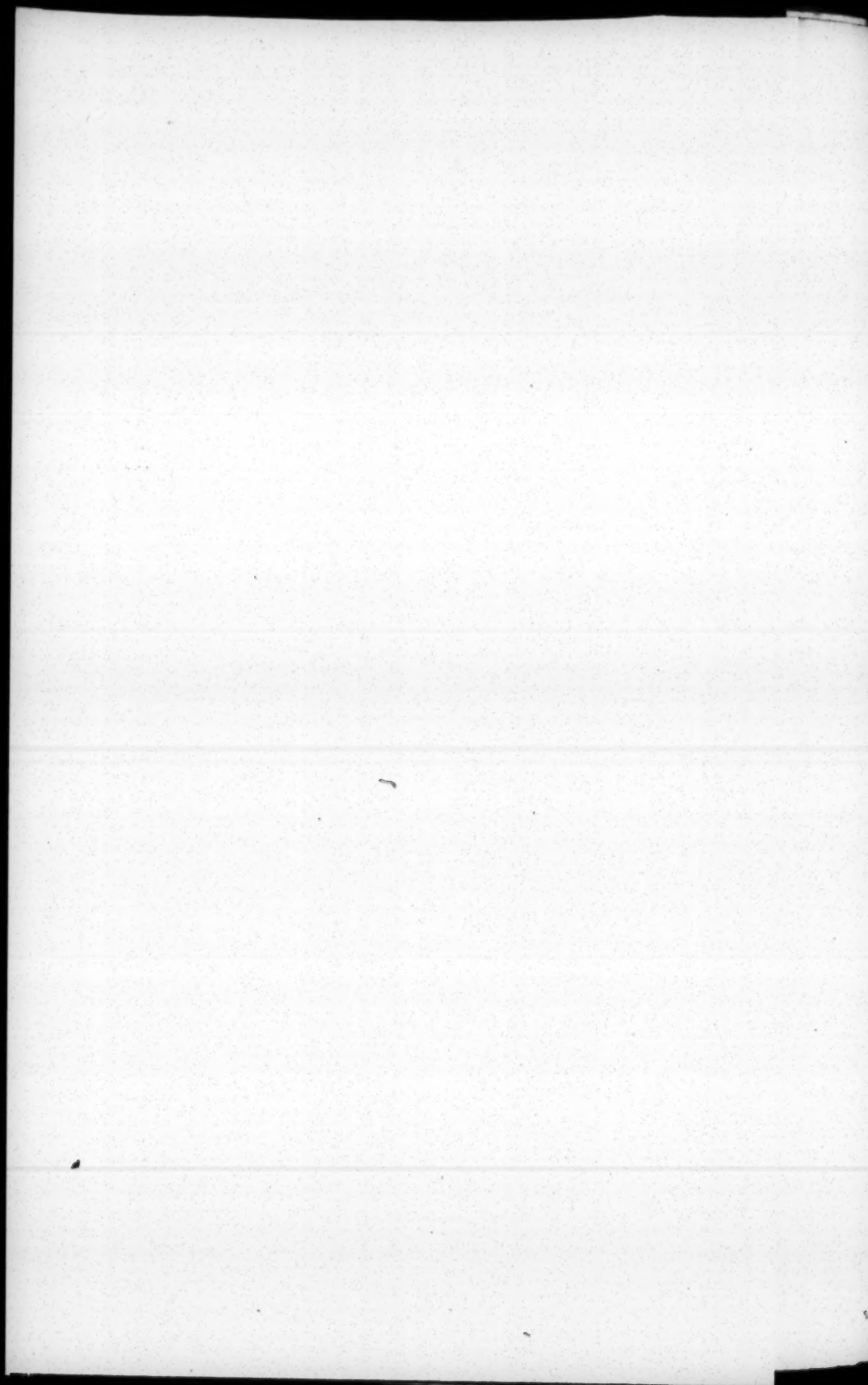


The Inside of y^e Waff



Wasp's Nest.

B. Cole. Sculp.



destroy'd. Last night my servants made the discovery, and storm'd it with fire and brimstone. When they had routed the enemy, they inform'd me they had found a pannier like a gourd. I presently knew what it was, and determin'd to preserve it, as a curiosity worthy of your observation and acceptance. This is the city, Sir, that I have been talking of. But we will drop the terms of city, pillars, and piazzas: In short, we will personate the architect no longer; but discourse of things simply as they are. There is enough of the marvellous, unmix'd with fiction, to entertain you; that marvellous which good sense demands, and which I am sensible is the very thing you admire.

Cher. I shall take it as a favour then, if you'll oblige me with the origin of wasps, and the method they observe in the building of their nests.

Prior. The inhabitants of this pannier are of three sorts: * First, the females, who are very large, and their number originally very inconsiderable: Secondly, the males, who are not quite so large; but are much more numerous: Thirdly, the mules, (if I may be allow'd the expression) that is to say, such wasps as are neither males nor females, and are obliged to bear the burthen of the day. These are much smaller than the males; much more numerous, and, in short, the body or populace of the nation. These wasps have three several sorts of employment: First, the structure of their hive; secondly, the care of bringing in proper provisions; and, lastly, the laying their eggs, and rearing their young ones.

As to the building of their nest, they begin their work about *Midsummer*, and make choice of some subterranean cavern, begun by field-mice, or moles; or otherwise, they begin it themselves; but always on an eminence, that the water may fall off, and not incommode their habitations. When they have pitch'd upon a proper spot of ground, they work with unweary'd diligence and application: They not only dig up the earth, but convey it away to some distant place, where it can be no incumbrance. They must, doubtless, be very

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active,

* Memoirs of the Acad. of Sciences, M. de Reaumur, 1719.

active, since in a few days they'll build themselves a hive a foot deep, and a foot broad, in the ground. Whilst some of them are digging, others are in the fields, in search after proper materials for the erection of the fabrick; and in proportion to the dimensions of their cavity, they strengthen the roof, or vault, and prevent its sinking in, by a cement of tenacious glew. There they lay the foundation of their building, which they carry on gradually, by working downwards, as if they were to form a bell, and close it at the bottom.

Chew. How is it possible, Sir, that they should sink and convey the earth away, in the manner you mention? For my part, I can't conceive how flies can ever be capable of digging themselves such a deep habitation.

Prior. They are furnish'd with as good tools as can be desired for that purpose. They have a trunk to their mouths, and near it two little saws, which pay from the right to the left, one against the other. Moreover, they have two large horns, and six feet. Whether they make use of their trunk or not, on this occasion, I cannot absolutely determine; but they cut the earth in the first place, with their little saws, into small particles, and carry it away in their paws.

Chew. I long, methinks, to know all the materials of which this wonderful fabrick is composed.

Prior. The whole consists of wood and glew. The mules have recourse for their wood to window-frames, pole-hedges, or the roofs of houses. They saw off, and carry away a large quantity of little sprigs, which, when they have hack'd and hew'd as small as they think convenient, they lay them up in a heap with their paws, and diffuse upon them a few drops of a glutinous fluid, of which they have a fund, or stock, in their bellies; by virtue whereof they raise a paste of the whole, and work it round like a ball. At their return home, they clap the ball upon that part of the building which they propose to extend, or make stronger and more substantial. This paste they spread abroad with their trunk, and their paws; falling always backwards in the operation. When the ball is laid flat and smooth, the wasp returns to his first post. He then presses, and spreads it over

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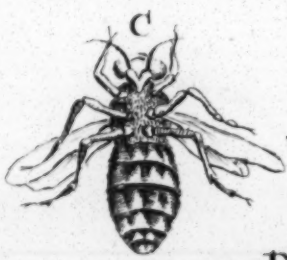
Plate 12, p. 72.

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Wasps

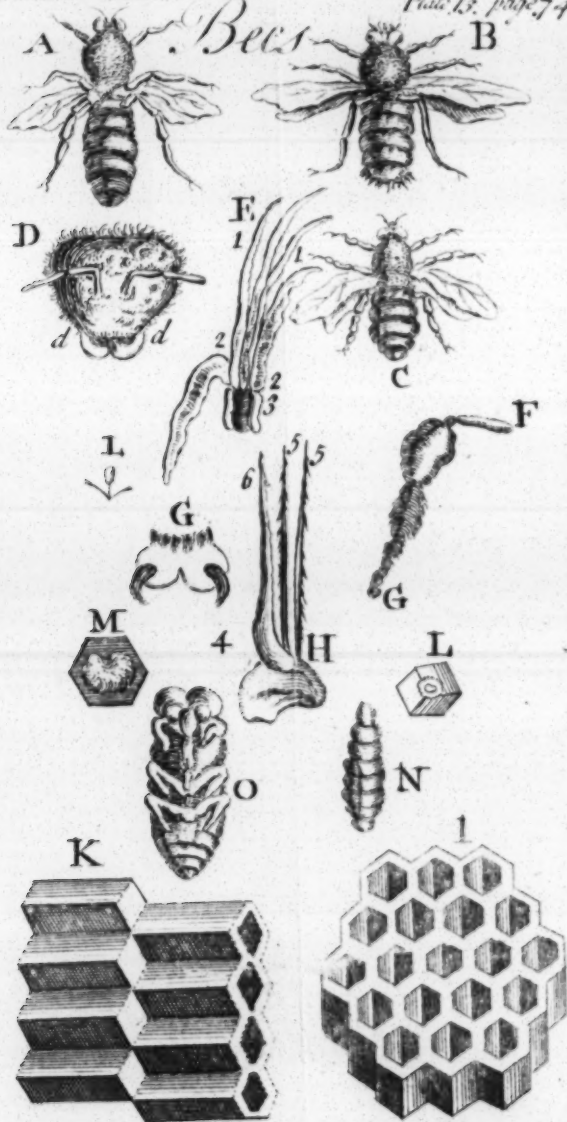
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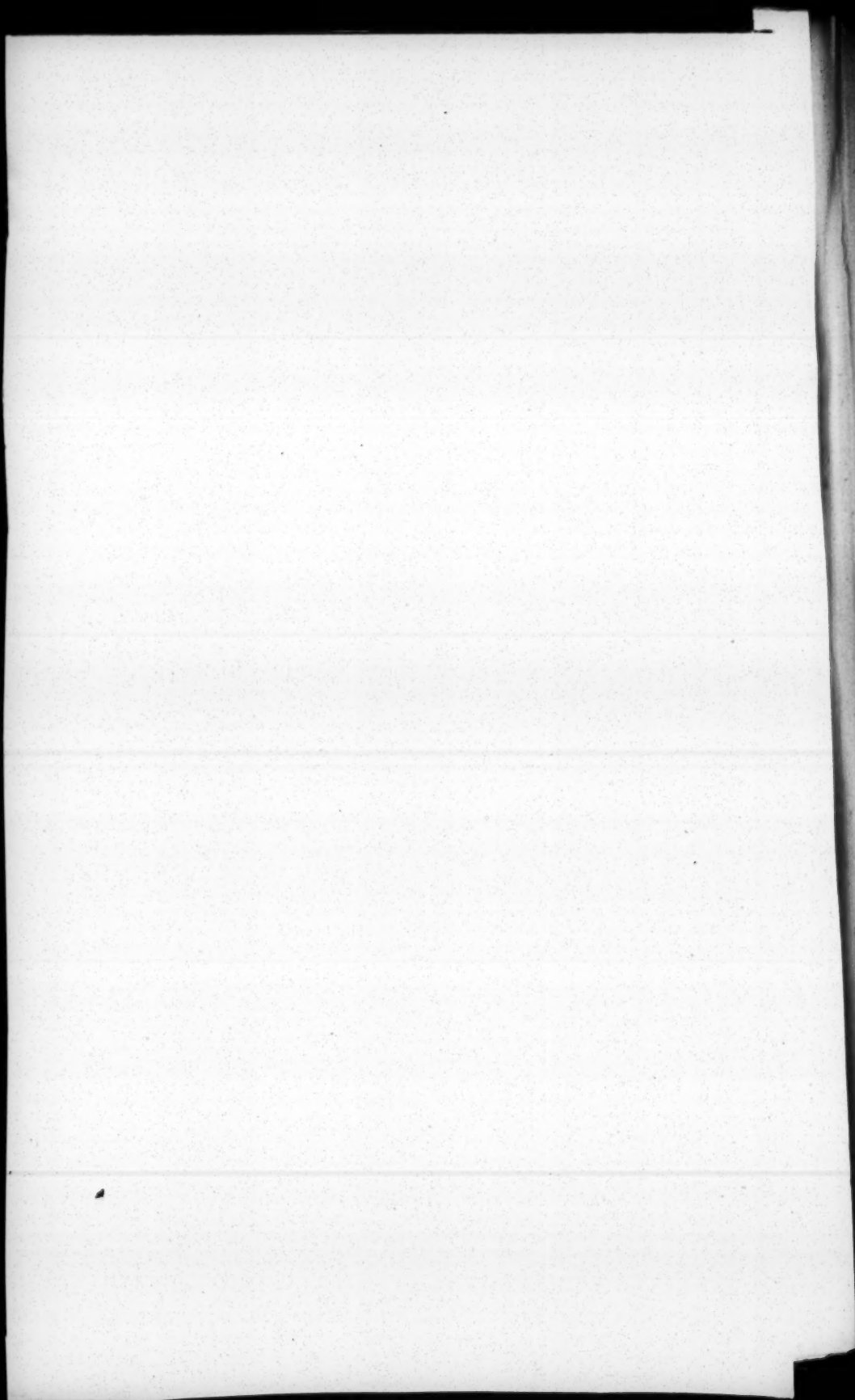
Vol. I.



B Cole Sculp

Bees





over again, observing punctually the same retrograde motion as before. When this operation has been repeated twice or thrice, this paste, thus composed of wood and glew, is converted into a grey colour'd leaf, which is far thinner than our finest paper. The mule, having thus duly manufactured his first ball, repairs immediately to the field for more materials; all which he converts by degrees into leaves, and spreads them one over another.

Some other mules lay new ones on the former; and all these leaves, thus bound and cemented with the same glew, form the grand arch-hoof, or dome, that covers the whole nest. The lodgment and pillars are all made of the same materials.

Chev. If I can form a right judgment, by my touch, the pillars are much stronger than the roof.

Prior. Your observation, Sir, is very just. They take peculiar care to make their columns extremely hard. Whether they are more compact, or cemented with a larger quantity of glew, I am at a loss to determine; but 'tis highly natural, that what sustains the fabrick, should be the most solid and substantial.

Chev. I should be glad, Sir, to know the reason why those pillars are extended, or swell out, more at the two extremities, where they touch the stories above and below, than in any other part.

Prior. The materials are spared with judgment and frugality in the body, or shaft of the pillar; but it could neither support itself on its basis, or sustain the master-beam, were it not well fix'd and glew'd at the points of contact. The two extremities are swelled, in order to cover a larger surface, and a greater quantity of glew is bestow'd on the top and bottom, to make the fabrick more firm and solid.

Chev. There seems, indeed, abundance of art and contrivance in all this: But I can't rightly conceive the use of these two apertures.

Prior. One is the entrance into the nest, and the other a passage out of it. The mules, that come home loaded, always go in at the former; those, on the other hand, that are going abroad, sally out at the latter;

and by a strict observance of this rule, their business is carried on without the least interruption.

Chev. I perceive too, that they can pass and repass at pleasure, under each story, and enter into any of the lodgments. All the doors stand open, I find, except some few, which are closed up with a kind of parchment. — Here are others likewise shut up in the same manner.

Prior. I'll account for that in a few words. But first tell me, if you please, Sir, how many stories do you see, raised one above another, like a pile of cakes.

Chev. If I am not mistaken, Sir, there are eleven. That, however, at the top is very small, and so is this at the bottom: Towards the middle of the pannier, indeed, their dimensions are considerably larger.

Prior. What I think the most remarkable is, that some whole cakes shall consist of spacious apartments, and others of such as are very scanty. The large lodgments are set apart for the reception of those eggs, from whence the males and females are to proceed; the narrow apartments for those, out of which the mules are to be produced, which, with respect to size, are much the smallest animals. Our architects never make any mistakes in their proper dimensions, and the dams never lay that egg, which is to produce a male or female, into the lodge of a mule-wasp. The chambers appropriated for these mules are between seven and eight lines * in depth, and about three or more in breadth: The columns may be about six lines in height.

Chev. I observe there are about forty pillars between one story and another.

Prior. Sometimes you may meet with more. But, for the present, take notice of the regularity of the lodgments. They are all hexagonal, which is the most commodious form that can be devised for a row of them, where there are no intervals, or void spaces. Were they orbicular, they would touch each other in one single point only, and the vacuity then would be wholly lost: Were they triangular, or square, they would, doubtless, be very compact and close; but then the angles within would have been lost, since the insect, for
whose

* The twelfth part of an Inch,

whose reception they are design'd, lies in a globular form. Hexagons come nearest to a circular figure, and their sides all touch so exactly one another, that there is no useless interval between them; insomuch, that each lodge, notwithstanding the weakness of its structure, becomes firm and durable, by virtue of its conjunction with the others.

Chev. The regularity of these lodges is, I own, the just object of our admiration. But I'll now beg the favour of you to give me some short account of the provision of these insects; for I plainly perceive you are thoroughly acquainted with every particular in this little nation.

Prior. I readily forgive them all the injuries they have done me, and the honey they have stolen from me, in consideration of the pleasure I have taken in studying their way of life. They generally plant themselves as near to a bee-hive, a vineyard, or a garden well stock'd with grapes, as conveniently they can; or else, which is still more agreeable, to some good kitchen, where there is plenty of provision, prepared without farther trouble. The mule-wasps, and even the males, range round the fields in pursuit of their prey; no danger intimidates them; and they'll resolutely rush even into a hive of bees, who are sometimes scarce able to repel their force. If they can steal no honey, they have recourse to the choicest fruits. The apricot, the bon-chretien, the rouselet,* and other mellow pears; the ripest peaches, and the sweetest grapes, are their favourite food, according to the season: However, they are not so over-curious as one may imagine; for at other times they'll sit down contented with much meaner fare. Whatever a kitchen affords is palatable enough. If they can find neither wild fowl nor tame, either lard or bacon, beef, or veal will go down with them. If they see a butcher's stall in their road, they fix their eye on what they fancy most, and stay there to bait. When they move off, they take with them large pieces of flesh, almost as big as themselves. This they carry directly to their nest, and the females divide it into equal proportions, and give it

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* A Summer-pear.

it to their young. The butchers, who study their own interest, compromise the matter with them, and make them a present of some bullocks, or calves liver, which they chuse before any meat that is full of fibres. 'Tis not with a view only to divert them from meddling with any of their other commoditie, that the butchers make this composition with them; 'tis for their own private ends, that they are no ways displeased with a visit from these creatures; for whilst they are regaling themselves on the liver before mention'd, there is no danger of any liquorish flies, or any other insects, coming near the shambles. The wasps chace them, and give them no quarter; they stand centry over it; and that must be a resolute and courageous fly indeed that will make the attempt in their presence. The worst that can happen is this, that the wasps may sometimes make bold to taste of what is not provided for them; but even then, the inconvenience is not worth taking notice of; because the wasp is a very cleanly creature, and defiles nothing. The females are for ever at home, attending their eggs; whereas the fly embraces every opportunity she can find to lay her eggs on one piece of meat or another, which sometimes proves very detrimental to the butchers.

Chew. I am almost in love with the wasps, they are such sprightly creatures.

Prior. I find you are prejudic'd in their favour, on account of their industry and neatness: But to confess ingenuously, their bad qualities depretiate in a great measure the merit of their good ones; for they are very rapacious, and naturally very cruel; they are, if I may be allowed the allusion, perfect pyrates and cannibals, with respect to the community of bees. They are not satisfied with plundering their hives, but murder them without mercy. They seize them, torture them, tear them to pieces, nay, eat them alive. These, Sir, are no very commendable qualifications; but on the contrary, highly blame worthy; and yet, to our shame be it spoken, they bear too near a resemblance to some of our own species. Nay, some of our *Europeans* are equally inhumane, and much more inexcusable. The wasps are rapacious by a natural instinct, which directs their actions;

tions; whereas man is injurious to his fellow-creature out of choice, and in direct opposition to the dictates of his reason. The wasps likewise have a numerous issue to provide for, which is a still farther extenuation, if I may be allow'd the expression, of their crime. — Excuse this short digression. — I come now to the distribution of their food, which is perform'd with all the justice and regularity imaginable. This is the peculiar province of the females; tho' the male-wasps indeed sometimes attend, and assist them.

In the first place, upon a strict examination, we find a little egg at the bottom of each lodge, fastned there with a glutinous matter to prevent it from falling. The female, we see, frequently enters into this lodge, and communicates, beyond contradiction, a genial heat to the egg, that the animal enclosed may force its way with the greater ease. Out of this egg springs a little worm, which is rear'd with the utmost tenderness and care, grows large, fat, and plump, and with his roundness fills the whole apartment. The dam, after she has receiv'd and cut the provisions, brought her by the males, into little parcels or portions, goes from lodge to lodge, and distributes them with the utmost impartiality, amongst the little worms; except indeed she is something more liberal to such large worms, as are to produce the males and females. Turn the nest up, Sir, and cast your eye on the entrance to these apartments. Do you perceive nothing remarkable?

Cher. Yes, Sir, one of those large worms you just now mentioned. Here's another, that opens its mouth, and takes my finger for its mother.

Prior. It has been neglected ever since yesterday. No wonder its appetite is so keen.

Cher. But see, Sir! here are several lodges quite shut up. How comes that to pass?

Prior. Why, I'll tell you. All these little worms cease, after a certain time limited, to be an incumbrance to their mother: They'll eat no more, receive no farther sustenance; but begin to spin with their mouths a very fine silk, the first end whereof they glew to their chamber-door; then wreathing their heads backwards and forwards, they fasten this thread to divers places;

and, by virtue of their passing and repassing, form with the thread, which always lengthens as they move, a light stuff wherewith they stop up the door. Thus retir'd, they divest themselves of their skin; the worm dies, their tatter'd remnants fall to the bottom of the lodge, and there is nothing now remaining but a white nymph, that disengages by degrees its feet, and wings, and insensibly assumes the form and colour of a perfect wasp. Break two or three of these enclosed lodges, and you shall find the insect swaddled up, as it were, and one half of the delicate limbs of the animal to arise from it, not exposed to view. He fortifies himself by slow degrees in this little lodge, where he lies secure from harm, till he disengage his feet, and breaks the inclosure wherein he was confin'd. This is what I am going to shew you. Take it in your hand. 'Tis one of these worms transform'd to a nymph.

Chev. What a pretty figure it makes, with its chin poked out; its prominent back; and its feet all gather'd up into a heap!

Prior. There are some insects, Sir, that continue in this state of a nymph for some years together: The wasp, however, is seldom confin'd above twelve, or fifteen days at farthest; after which, finding itself, in every respect, duly equipp'd, it breaks down the door of its apartment. You may then see him thrust out one horn, and after that the other; a leg appears in the next place; and then the head and body enlarge the opening. As soon as he comes out a complete wasp, he dries his wings, which are all wet, with his hinder feet: Then at once you see him take his flight, and range the fields in pursuit of some booty, with the rest of his species; whose dexterity and address, as well as malignant qualities, he copies from that very moment.

Chev. What! without any previous instruction?

Prior. Yes, Sir.—No sooner is the mule-wasp released from its imprisonment, but it flies plundering about. When the male finds himself at liberty, he takes some short time for his diversion; and after that, pays his addresses to the queen of that district to which he belongs. But when the female is freed from her confinement,

finement, she makes the affairs of her family her sole and constant employment.

Chew. I perceive the mothers in this country have a rare time of it. But as for the poor mule-wasps, methinks, I pity them with all my heart. They have very just grounds of complaint; for the whole burden and fatigue of the work is laid upon their shoulders.

Prior. It must be granted, that the mothers are well provided for: The best of their provision is appropriated to their service; they are well attended, and shew'd abundance of respect: Not only the males, but the whole clan are perfect courtiers: But then it must be consider'd, the number of their females is but very small. They have a very heavy task upon their hands: Such a large family to take care of; so large a quantity of eggs to lay; such a numerous offspring to rear; so many visits to pay from story to story, and lodge to lodge; such impartial justice to be shewn to all, and the necessity of running the same everlasting round from day to day, without one moment's respite, or leisure to stir abroad: All this, I say, must surely be such a confinement, that nothing in life can well be conceiv'd more laborious and fatiguing. All these circumstances duly weigh'd, you must allow the station of a mother-wasp to be less happy and agreeable than you imagin'd it to be at first view. As to the mules, for whom you seem to express such a friendly concern, their situation is, in effect, much more easy, and much rather to be chosen than the former. They take their flight for provision where they please: range round the meadows, and plunder all they meet; eat and sleep without any care or concern; and, in short, are the happiest branch of the whole clan.

Chew. Pray, Sir, inform me, Do the wasps hoard up any provision against the winter?

Prior. No, Sir. They have no regard to futurity.

Chew. How then do they subsist, during that long and comfortless season?

Prior. At the approach of the winter there is a perfect revolution in their republick. As soon as the hard weather comes on, the mothers and their consorts, who

before were so tender and indulgent, now destroy their young without the least reluctance or remorse. Eggs, worms, nymphs, wasps completely form'd, all are thrown out of doors, and the lodges themselves are broke down, and left in ruins.

Cher. What can create such a general desolation? and what should inspire them with such sudden rage and resentment?

Prior. They are conscious that they have no longer time assign'd them for bringing their * embryos to perfection; and for that reason, are determin'd to give themselves no fruitless trouble. When the sun shines, they sometimes take an airing; but yet they enjoy no real satisfaction. They are all disconsolate, dispers'd here and there, endeavour to shelter themselves from the injuries of the weather, and to find a lodging wherever they can. Such as remain in the nest, live without having, or indeed seeking out for any subsistence. The cold weather pinches them, makes them languid and inactive, or absolutely kills them; and out of eight or nine thousand wasps or more, that resided in the nest, not above two or three of the mothers perhaps shall survive the general calamity.

Cher. How then is the species preserv'd?

Prior. The dams are more vigorous, and can bear the cold much better than the males, or mules. Perhaps you'll think it very strange, but 'tis fact, I'll assure you, that one female wasp is sufficient to produce a whole swarm the next summer. She erects, either in the trunk of a tree, or the hole of a wall, two or three cells, or lodges, which lie like a bunch of flowers, and are fasten'd by the stalk with a glutinous substance to the wall. There she lays two eggs, from whence two mule-wasps in a short time proceed. She seeks out for proper food to rear them. The whole care and concern you see lies upon her. The two little worms are soon glutted with their diet. In a few days time they spin, and shut up the door of their cell. Thus you see there are two young wasps already provided for. The mother is now discharged of the care of providing for them any longer. She builds two other cells; and whilst the two new eggs which

* Wasps, before they have their perfect shape.

which she has laid are hatching, and the young ones gathering strength, the two first mule-wasps extricate themselves out of the web that enclosed them, and become assistants to their mother. Now, Sir, there are three in company. Fifteen days after this, the two latter break out of their confinement, and encrease the number. This little bunch of cells is daily augmenting, and the dam lays therein first a male, and then a female egg. One would imagine she does all this by express command. The male becomes a gay bridegroom, and the female a teeming bride. If there happen to be two dams in the month of *May*, the number will be increased to fifty, in less than three months after; and from those fifty will proceed above ten thousand wasps before *October*.

'Tis not to be expected, but that so numerous a family should be dispers'd, and scatter'd here and there. After the mothers, who have stood the severities of the winter season, have formed several little districts, and planted inhabitants in each of them, the whole body of them assemble together from all parts, and provide for themselves in *June*, a large and commodious apartment, such an one as this now produced before you, wherein they enjoy all the advantages of a friendly community.

Thus have I given you, my dear Chevalier, all the observations that I have made with respect to wasps. I shall not trouble you with a particular detail of any other species of these insects; some of which hang their nests upon the branches of trees; and others, who are as large again, and sometimes twice as large as the common sort, build their nest under the roof of a house, or in a timber-yard; since much the same industry, and prudent deportment, is conspicuous in both; and you may form an adequate idea of the operations of these last, from what I have already related with respect to the common wasps, on whose conduct and œconomy I have had greater opportunities to make my observations.

Chev. But, Sir, you have not, as yet, made the least mention of their sting. Are they furnish'd with any such weapon?

Prior:

Prior. Yes, that they are.—I know it, I can assure you, by woeful experience. I have smarted pretty severely more than once for the gratification of my curiosity: But I don't reflect on the pain with the least regret; and I would very willingly expose myself to greater hazards, if I could contribute, by that means, towards your improvement in any branch of useful knowledge.

Chew. 'Tis highly unreasonable that I should have all the pleasure, and you, Sir, all the pain.

Prior. Excuse me, Sir. Nothing is more just. 'Tis but meet and requisite that thorns and stings should be the portion of him who undertakes the instruction of others, and that nothing but pleasure should attend those who are willing to be taught.

Chew. I think myself happy in falling into such good hands.—I could wish, Sir, if it would not be too much trouble, that you would make a transition from these wasps to bees.

Prior. That I shall do with all the pleasure imaginable; and in explaining to you the structure of their stings, I shall give you an adequate idea of that of the wasp, since 'tis exactly the same.—But we must defer this topick to a more favourable opportunity. 'Tis impossible for me to enter upon it at present; for I find there is company waiting for me at the door. I am a perfect servant to my parishioners, that's the truth of it; and since 'tis with the utmost reluctance that I leave you, I know your good nature will excuse me.



B E E S.

D I A L O G U E VI.

The Count and Countess, the Prior, and
the Chevalier.

Count. **A**T last, Sir, we are perfectly disengag'd. The Prior has sent us word that he'll wait on us immediately. In the mean time, pray, What was the subject of your yesterday's conversation?

Chev. The Prior, my Lord, instead of making an harrangue on the various conditions, and employments of the wasps, made me a present of one of their nests. He shew'd me an inclosure, in which there were several stories one above another, and a great number of cells or lodgments; some of them quite open, where there was nothing but one egg, or at most but one living worm: Others were shut close, wherein the nymphs were lodg'd which were ready to become perfect wasps: Others, again, had their doors shattered; and I saw a most beautiful wasp issue from one of them, as I was carrying the nest which the Prior gave me, into my chamber. I design to have a box made on purpose [to preserve it.

Count. Take special care, however, that it lies in the sun, or before a fire for some days, in order to destroy the few insects that may be still subsisting. I need not assign any reason for my giving you this precaution. As to the rest, I am extremely pleas'd that you have an adequate idea of the labours of a wasp; since thereby
you

you will comprehend with greater ease the account we shall give you instantly of bees.

Chev. See! Madam, the Prior is moving towards us as fast as he can. He has got something, I perceive, under his arm: Some new present, in all probability, for my amusement and information.

Countess. 'Tis really so; some new essay to give you ocular demonstration. Nothing less than a honey-comb, Sir, I'll assure you. That will be a novelty to me indeed; for I never saw one in my life. 'Tis a happiness to have any thing to do with the Prior; for he gratifies our wishes in an instant.

Prior. I had no occasion, Sir, to go a great way for what I have brought. I had it in the house.

Count. Well then, let us take our seats, and make the labours of the bee the subject of our present conference.

Prior. No topick could be more suitably propos'd: For yesterday, I entertained the Chevalier with nothing but a detail of thefts, robberies on the highway, battles, and bloody murders: To-day our conversation must turn on nothing but œconomy, politicks, and industry; for all these make up the distinguishing character of the common-wealth of bees. All that can be offered on the subject, may be reduced under two heads. One comprehends such particulars as are obvious to all mankind, and with which the most illiterate peasant is perfectly acquainted: The other contains topicks of a more curious nature, such as cannot be discover'd without the assistance of a glass-hive, and the eyes of a philosopher. As to the former, we'll not give his Lordship any trouble about them; but as he is well provided for the illustration of the latter, we'll beg of him to oblige us with his observations.

Chev. Is it true, Sir, that these bees are govern'd by a king?

Prior. That there are three sorts of bees in a * hive, is true beyond all contradiction. The first are the populace, and the most laborious part of the nation, who
seem

* Memoirs of the Acad. of Sciences, 1712, Mr. Maraldi. L'cunwenhoeck's Arcan. Nat. Tom. 3. Ep. 133.

seem to be neither male nor female. Each of them has a trunk to assist him in the execution of his work, and a sting to defend himself, in case of an assault, or any invasion. In the second place, the drones, who, for the generality, though not always, are of a darker hue, and one third longer and larger than the former. These are looked upon to be the males, and those that have no stings. * There are about a hundred of this species in a small hive of seven or eight thousand bees ; but three or four times the number, when the hive is large, and contains between seventeen or eighteen thousand. And lastly, the third species are not only much stronger, and larger than the drones themselves, but they have stings likewise, as well as the populace, or common bees. 'Tis the received opinion, that there is but one supreme, or sovereign bee, in each hive ; or, at least, but one in each swarm ; that is to say, in each colony of those young bees, who sally out of the hive from time to time in search after some new situation. Whether this sovereign of theirs should be dignified and distinguished by the title of their king, according to the ancients, or their queen, according to the moderns, I shall submit entirely to his Lordship's superior judgment.

Count. By the help of my glass-hive, I have observ'd very perfectly the three classes of bees which the Prior speaks of. I have frequently seen, likewise, the sovereign bee, by some called their king, marching in state, from one apartment to another. There was nothing at the bottom of the cell, till the insect plung'd the extremity of her body into it. When it withdrew, I have perceived a small egg left behind. From whence we may reasonably conclude, that this illustrious personage is of the female kind : And, as I have frequently observed, that there has been in a whole swarm but one of this species, (who is very easily to be distinguish'd) sometimes two, but never more than three ; 'tis much more natural to give her the title of queen, than king. However, I would not disagree with those that maintain the contrary opinion. But let us hear what the Prior thinks of those bees, who go under the general denomination of drones. They are not foreigners, for I have

have seen them born in cells, (prepared on purpose for them) which are more spacious than the others. What is their peculiar province, Doctor? Are they the queen's royal consorts? My hive has not yet given me an opportunity to be fully satisfied in that particular.

Prior. What I know of drones, my Lord, is this. They have all of them a bag of honey in their bellies, as other bees have; with this difference, that the common sort have their bag continued by a little passage to their very necks, through which they pour out their honey into the general magazine; and if you squeeze a bee never so gently, the honey will distil immediately through that narrow canal; but you'll find no evacuation upon the squeezing of a drone. He eats, and no one but himself reaps the benefit and advantage of it: He contributes nothing to the publick stock; he is well provided for; he does no manner of work, nor even ranges round the fields. He takes a turn or two, indeed, now and then, to air himself, and walks round the hive, without the least interruption. As he has no enemy to fear, so nature has given him no sting for his defence. As to the rest, I can't be persuaded, that such indolent members would be suffer'd in a state so remarkable for their conduct and œconomy, if they were not reserved for some service or another. Some conjecture, that their principal employment is to furnish the queen with a numerous progeny, or more properly speaking, to people the state with subjects.

Count. There is something remarkable besides this. By the anatomy of a drone, some naturalists have imagined, that they were the authors of generation. I have used my utmost endeavours to find out, by prying with all the attention imaginable, through my transparent hive, what character those drones maintain'd in the state: And all the observation that I could make, is this. The queen keeps herself retired in the upper chambers of the comb; which, if you please, we'll call her palace. She very seldom makes her publick appearance, but whenever she condescends so far, she moves with a very graceful, grave, and majestic air. You smile, Cavalier, but 'tis actually true: Nay, more; she never walks alone, and although she is not attended by the whole

whole swarm, she is at least accompanied by several of the largest bees, in all probability, her favourite drones, who form her court. As her majesty but seldom appears in public, and is always consulting the welfare of her people, whenever she takes her walks, there is a grand festival proclaim'd through all her dominions: The whole nation are abroad, and every subject's heart overflows with joy. As a testimony of their love, and ambition to give her the most solemn reception, the bees hang in clusters by their feet, and, in the twinkling of an eye, form a large veil, behind which nothing can possibly be seen. This veil, if you please, we'll suppose to be a fine piece of tapestry, hung out in honour of her majesty's procession; or else a curtain which her domesticks draw before her. * * * * *

Prior. Your Lordship attributes to these creatures either very noble intentions, or such as are extremely modest.

Chew. Is not that ceremony one of their country-dances, on these publick occasions?

Countess. A dance! As for my part, I can say nothing to the matter; but 'tis the last thing the Prior will allow, that I know very well; for he is no admirer of that diversion.

Count. As to the rest, whatever may be the real intention of these insects in the observation of this custom, and joining thus in chorus at the approach of their queen, 'tis indisputably matter of fact; and I have observed, that after the ceremony was over, her majesty has proceeded from one apartment to another, and laid an egg in private, wherever she found them clean and empty; and as often as she plung'd the extremity of her body into any particular cell, the drones of her court rang'd themselves all in a circle round her, and turning their faces towards their sovereign, clapt their wings for joy, and seem'd to solemnize the birth-day of her royal issue. Ten or twelve, and sometimes more of these empty apartments, are filled with new inhabitants at every fecundation: And she herself, in the space of one year, shall sometimes give birth to six or seven thousand young ones; and, by the joint endeavours of two or three other prolific females like herself, shall see her

her childrens children, and, in one summer, be the first parent of above eighteen thousand descendants.

Prior. What seems to me to be an incontestable proof that these drones are so many stallions, appropriated to no other service than the multiplication of their species, is this; that they are plentifully provided for all the summer-season; but when these queens have discharg'd their swarms, and autumn approaches, at which time 'tis foreseen, that there will not be time or heat sufficient to rear a new family; then the drones are under disgrace, and turn'd out of doors, as being a burden to the Common-wealth. The bees will no longer give them house-room. Their malice extends even to such young drones as are still in the egg-shell. They pluck them out of their cells, kill them, and then cast them out of the hive. Their fathers after this feel the weight of their resentment. 'Tis in vain for them to be obstinate, and think of maintaining their station; they lay hold of their wings and shoulders, thrust them about, and harass and fatigue them; they drive them all out, in short, without the least favour or affection; except, perhaps, a small number, of a less rapacious species, be maintain'd at a moderate expence. These few are reserved to supply the necessities of the ensuing year. This is a circumstance that I the rather take notice of, because the queen is pregnant again in the spring; tho' sometimes the drones that are amongst them are very little, if any thing, larger than the common bees.

Chev. Pray, what becomes of these poor drones? Methinks I am concern'd for them.

Prior. They are expos'd to the wide world. Their circumstances are doubtless very deplorable. In all probability they associate with the wild bees. In short, 'tis a difficult matter to say justly what becomes of them.

Countess. The husbands, I perceive, make but an awkward figure in that country.

Count. 'Tis a maxim of theirs, that the welfare of the subject should be the first and principal law of the state.

Prior. The bees don't think themselves under any obligation to maintain a pack of indolent creatures, who would devour in one part of the year, all the product
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of the other ; more especially, at a time when they themselves can find nothing else to subsist on. Thus you see, my dear Chevalier, if they oblige the drones to provide for themselves, 'tis not the result of common prudence only, but absolute necessity.

Chev. I don't wonder that you are an advocate for the bees ; I know they are your favourite insects.

Prior. They are so ; and 'tis highly reasonable that I should espouse their interest, since they bring me in an annual revenue.

Chev. That's not the true reason of your indulgence towards them ; but you are fond of them because they punctually observe the doctrine which you preach, that *Such as won't work, shan't eat.*

Prior. That may very well be, Sir. But, all complaisance and interest apart, 'tis impossible to give the least attention to the maxims and manners of these people, and not be charm'd with their conduct as well as their industry.

Chev. As they are such shining examples of unwearied diligence, I should be glad if you would take their little labours into your consideration.

Prior. That point I shall discuss immediately. But in the first place it will be requisite to give you a short account of the utensils with which nature has furnish'd them for the execution of their designs. As the Count, however, has survey'd them with his microscope, with much more accuracy than I have ever done, we'll beg the favour of him to oblige us with a description of them.

Count. With all my heart. But don't expect that I should give you the exact analysis of the body of a bee ; it will be sufficient to take notice of their principal parts, and the various uses to which they are assign'd.

The body of a bee is divided by two ligaments into three parts ; that is, the head, the breast, and the belly. The first is arm'd with two jaws and a trunk. The jaws, or saws, in their playing, open and shut, from the left to the right, and serve them instead of hands, to hold fast, and knead their wax, and to throw out of their hive whatever encumbers or incommodes them.

them. The trunk is a ———. But I'll follow the Prior's method, and give you ocular demonstration, as I have my instruments at hand. I have here two trunks glew'd upon two several pieces of paper. Pray, my dear Chevalier, view them attentively with this microscope one after another.

Prior. They could not be more advantageously dispos'd. Perhaps the Chevalier may imagine, that these two figures are the same; and in all respects like one another.

Chev. One, I perceive, is near as long again as the other. The longest is thick at one end, and gradually diminishes towards the other: 'Tis a little crook'd towards the middle, and at the bottom encompass'd by four branches, which are hollow within, like a reed, that is cut into four pieces. I can't comprehend all this.

Count. Your observation, however, is very just. Have a little patience, and take a view of the other.

Chev. The other is thicker, and much shorter; neither are there any branches round about it.

Count. What! No branches! ——— Pray, Sir, look again.

Chev. I beg your pardon, my Lord; I think I can discern them very plainly now. They are directly before my eyes. This second trunk must certainly be sheathed; so that the branches are, as it were, the scabbard for it. The first trunk is drawn, and ready to work with; and the second is put up, and at peace in its sheath. This convinces me of the justice of your late observation, that the most minute things in nature have their proper ends assign'd them; and that the hand of the Supreme Being is as visible in the composition of a fly's paw, as in the structure of that glorious luminary the sun himself.

Prior. You should frequently reflect, that this appointment is certain, even in those things wherein it cannot be clearly demonstrated; because you'll find it in every step you proceed, tho' at first you could not rightly conceive it. 'Tis your duty to find it out, if you can; to admire it, and to glorify God when you have made the discovery. Let the trunk of a bee be

shewn

shewn to whom you please, it may be said, that 'tis nothing but a fly's paw; What is it good for? This implement, however, is of such singular service, that by the help of it, a bee will collect more honey in one day, than a hundred chymists could do in an hundred years. And the Wisdom of the Creator, that is thus conspicuous in bestowing on the bee this useful implement, is equally manifest in the means which he has furnish'd her with for its preservation. For this trunk is not only long and taper, but pliant and supple to the last degree, in order that the bee may therewith penetrate to the very bottom of a flower, notwithstanding all incumbrances, exhaust all its scatter'd juices, and carry off the treasure to his hive. However, was this trunk extended, it would prove very incommodious, and be liable to be broken by a thousand accidents. For which reason it consists of two pieces, united by a spring, or hinge: So that, after it has perform'd its proper function, it may be contracted, or rather folded up. And moreover, 'tis secur'd from all harms by four strong scales, which encompass it round about.

Count. We'll now proceed to another part of its body. The middle, that is, the breast of a bee, supports the legs, which are six in number, and the four wings, that is, two large, and two small ones, which she makes use of, not only to transfer herself from one place to another, but likewise by their noise, to give intimation to the bees of their departure and arrival, and to animate them in the exercise of their respective functions.—Here, Sir, is a dead bee. Observe the hair with which her whole body is covered, and which was of service to her in retaining the little grains of wax which fall from the top of the chives to the bottom of the flowers. Take notice, likewise, at the extremity of its paws, of the two little hooks, which will be visible enough in the microscope, and appear in the form of two pruning-hooks, set with their points one against the other, like the two horns on a bullock's head. Behind these claws are two little white balls, or sponges; the use whereof we have explain'd in one of our former conferences.

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The belly of a bee is divided into six ringlets, which are dilated and contracted, by sliding one over another. The inside of this part of her body consists of four parts, the intestines, the bag of honey, the bag of poison, and the sting.

The intestines are of service to her in the digestion of her food, as I'll explain to you more fully another time. The bag of honey is as transparent as crystal, and contains those liquid sweets which the bee extracts from flowers; a small portion whereof is reserv'd for her own nutriment; but the principal part is carried back, and poured into the little lodges of the magazines, for the maintenance and support of the whole community, during the winter-season. The bag of poison, or gall, is situated at the root of the sting, through which, as through a pipe, the bee diffuses as many drops as she thinks proper into the wound, in order to augment the pain.

Lastly, The sting consists of three parts, that is, of a sheath and two darts *. The former terminates in a very sharp point, and a little above it there is an orifice, for a free passage of the gall, and the two darts; one of which is considerably longer than the other. Both of them are set with small sharp points, much like the beard of a hook, which rising a little obliquely, render the wound more painful, hinder their return, and create the bee a great deal of trouble in the extraction of them: And, indeed, she very seldom draws them out, if the person stung either starts, or any ways interrupts her; but if he be patient, and puts her to no confusion, she lets those lateral points fall down upon the sting. By this means, she draws it out without any obstruction, and consequently the wound she gives is not near so painful. The sheath itself has likewise a sharp point, which gives the first puncture. This is immediately accompanied by another, proceeding from the darts, and the effusion of the venomous liquor. The muscles of this sheath are very strong, and enable the bee for the most part to extract it from the wound; but if she happens to dart it in too deep, these muscles are torn from the bee's body, and rest behind with the sting.

* Derham's Theol. Phys.

sting. The poisonous liquor, which she infuses at the same time into the wound, causes a fermentation and a swelling, which sometimes continues for two or three days. That ill consequence, however, may, in some measure, be prevented, by extracting the sting directly, and laying the wound a little open, that there may be room for the perspiration.

Thus much shall suffice with respect to the implements, or tools of their profession. We'll proceed, in the next place, to a description of their labours, and particularly to the structure of their combs.

Cher. With your Lordship's permission, I'll ask the Prior one question first. Pray, Sir, What measures do you generally take to assemble all your bees into one hive?

Prior. We'll suppose a swarm of these bees to be lodged either in the trunk of a hollow tree, in the hole of a wall, or in some hive which they have found, by mere accident, fit for their purpose. There they rear their young, and when they are grown to a mature age, bring up a second brood. The whole community, young and old, live in peace and unity together, as long as there are sufficient conveniencies for their reception. But when their number is so far augmented, as to disable them from rearing a new progeny, without abundance of trouble and fatigue; then the old bees, whose right and title is indisputable, and who are, in fact, the sovereigns of such republick, publish an edict, wherein it is ordered and enacted, that all the young bees of such a particular age, and under, shall find out some new settlement, and evacuate the place within a certain time limited, upon pain of incurring their high displeasure. As I never read the proclamation, indeed, 'tis possible I may be mistaken in the exact form of it: But this is certain, that in case any of the young ones prove malecontents, and think themselves injured, a bloody war is the certain result of their disobedience. For the generality, however, they testify all the duty and submission imaginable, and at a certain day and hour, or rather at one and the same moment, the whole swarm of young bees with their queen at their head, march out of the hive in form, and take their flight to some distant fields,

in search after some other agreeable situation. This young band may with propriety enough be called an actual colony. The old bees always maintain their privileges, and never quit their ancient habitation.

Chev. Meithinks I am attending to the history of the *Sidonians* and *Tyrians*, who being too much confined, and growing very numerous, dispatch'd several colonies not only to *Carthage* and *Cadiz*, but to divers other places.——However, I've done. I interrupt the story of the bees.

Prior. Whenever our young brood have taken their flight, we find they rove about sometimes for a long time buzzing in the air, in quest of a commodious retreat, and fix in one body or cluster, either on the trunk, or branches of some commodious tree. We may reasonably imagine, that they have their deputies, who act in the capacity of scouts; and when they have discover'd either a large breach in a wall, or a trunk of some old hollow tree, or an empty hive, which the country people, who are very vigilant on such occasions, and glad to accommodate them, throw in their way, first rubbing it over with balm, thyme, and such other odoriferous herbs as are most likely to allure them; the queen, either on a report made to her by a proper officer, or in pursuance of her own observation, puts herself on the march. The whole body, or cluster, thereupon disengage themselves, and attend her motions. She enters into the hive, so prepared for her, takes possession of the place, and settles there with all her subjects. 'Tis a common custom to ring a little bell, or tinkle some brass-pan, to give them intimation that there is a commodious apartment provided for their reception; the noise whereof has an extraordinary influence over them, and at once composes them. 'Tis not improbable, that they are deceived by this sound, and imagine it to be a peal of thunder, and the fore-runner of a storm. Be that as it will, at that very juncture, either through some awful apprehension, or particular composure of mind, which that kind of instrumental musick may create, they weigh with attention the service that is tender'd them. If you oblige them, by a gentle compulsion, to enter into the hive, they take it as an act

of complaisance; or perhaps their own natural inclinations; may induce them to fly there for shelter and protection. After this, tho' the person who presents them with the pannier removes it to some other place, yet they comply therewith, without shewing the least marks of their resentment. The hive accordingly is planted upon a stand, and composed of several planks laid flat, and nailed close together; or on a spot of ground, with brick-dust, or the shards of tiles strew'd plentifully over it, in order to prevent any insects, or noxious exhalations of the earth, from having any influence over it. There is care taken, that a small aperture shall be left at the bottom of the hive, and then they range themselves according to the constant method observed amongst them. As to their transactions within doors, his Lordship can give you a more satisfactory account than I pretend to.

Count. In our detail of the labours of these insects, the materials they make use of in building, the various ends and purposes for which that building is set apart, and the manner wherein the whole is accomplish'd, are all points to be duly and distinctly consider'd. As to the materials*, they are composed of nothing but glew and wax, which they extract from various flowers: With respect to the fabrick, 'tis intended as a commodious habitation for themselves, and their numerous issue: And as to their method of erecting it, give me leave to enumerate some few instances of their prudence and good conduct. Tho' I am a perfect stranger, I confess, to their language, yet that they have one, which they understand, and make use of for the communication of their thoughts to each other, is fact, I think, beyond all contradiction. When they begin to build their nest, they divide themselves into four several bands, or select companies: The first range over all the fields in quest of proper materials; the second work upon the materials that are brought home, and make a rough draught or plan of the intended structure; the third polish and complete it, examine with the utmost exactness the several angles, carry away the redundant wax, and bring

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the work, in short, to it's utmost beauty and perfection: the fourth attend with provisions on such as have not time to leave their work. No allowance, however, is made to that band who are employ'd abroad, because 'tis taken for granted they will not forget themselves: neither is there any portion allotted for those who begin the cells. Their branch of the work is really very difficult and troublesome, because 'tis their peculiar province, not only to lay the wax smooth, and extend it to its proper dimensions, but to cut and adjust it with their jaws: However, tho' their labour is very hard, yet they have orders, or permission at least, to leave off betimes. They then are at their free liberty to range round the fields, to regale themselves with whatever they can find, and make themselves sufficient compensation for their extraordinary trouble and fatigue. Such as succeed them, draw their mouths, their paws, and the extremities of their bodies again and again over the whole work, and never leave off till 'tis polish'd and completed to their satisfaction. As these last stand in need of frequent refreshments, and are not permitted notwithstanding to desist from their labour, there are attendants always ready to supply them with provisions, whenever they demand them.

Chev. Have you ever observed this transaction, my Lord?

Count. Very distinctly, Sir. Their wants are all express'd by signs. The labourer that's hungry, bows down his trunk before the providitor; and this is a sufficient mark or token that he has an inclination to eat. The caterer opens his bag of honey accordingly, and pours out a few drops, which roll all along the trunk, and swell each part of it through which the liquor passes. Thus refresh'd, he returns to his labours, and repeats his former motions.

Chev. Is it a long time before their work is completed?

Count. Tho' the accuracy and beauty of it is surprising, yet these labourers are so active and industrious*, that a comb, consisting of a double row of cells, back'd one against another, which is a foot long, and six inches

broad,

* Mr. Maraldi.

broad, is accomplish'd in a day's time, and is large enough for the reception of three thousand bees.

The symmetry of these combs is much more curious and complete than that of a wasp's-nest; for here the bottom of the cells not only terminates in a point, to receive the little egg, and collect the warmth into one center, which it would not do, in an equal degree, if it were laid on a flat; but this bottom is composed of little triangular pannels, which unite with the utmost regularity in a point, and answer exactly, pannel against pannel, to the like extremities of the opposite apartments. Observe likewise, that the form and disposition of their combs is quite different from those of wasps: For whereas the latter have but one row of cells in theirs, ranged horizontally one over another; those of the bees are double, or composed of two rows of cells, the bottoms whereof touch each other, and are perpendicularly suspended, with a space between both, large enough for the bees to pass backwards and forwards, and yet sufficiently contracted to secure as much warmth in every part as they can possibly require.

Chew. But here, my Lord, I find, at the entrance of all the apartments, a border, or ledge, by which the entrance at the door is made much narrower than the dimensions of the cell; whereas in that of the wasps, the entrance is as wide as the apartment itself.

Count. This is another testimony of their prudence and precaution. As bees live seven or eight years, and sometimes longer, and wasps, on the other hand, seldom survive the first year, (in which circumstance the conduct of Providence is very conspicuous, and demands our attention) the bees fortify the entrance into their cells with this ledge, which being united with that of the adjacent cells, renders the whole very solid and substantial; in-somuch that the work shall want no reparations for several years together, notwithstanding the many shocks, the ingress, egress, and repeated efforts of the mothers, who deposite their eggs in those cells; notwithstanding the vast numbers of labourers, who come there to deposite their wax or their honey; and the violent agitations of the nymphs, who when they actually become

bees, make very vigorous efforts to release themselves from their confinement.

Prior. There is a vast deal of difference, Sir, between these tenements of the bees and our habitations, which always decay as they grow old; whereas time makes the former more firm and solid.

Chew. How can that be?

Prior. The foundations of our houses sink with the ground whereon they are built; the walls begin to totter by degrees, drop with old age, and lose their first elevation. Lodgers damage every apartment, and the whole crazy fabrick is for ever wanting some new reparations. On the contrary, the habitations of the bees grow stronger and stronger by the admission of new inhabitants. Every worm, before she is transform'd into a nymph, hangs her skin on the partition of her apartment; but in such an exact manner, as to make it answer to the lines of the angles, and to do no prejudice whatever to the regularity and proportion of it. The same cell, in one summer, may be tenanted by three or four worms successively; and the next season, by three or four others. Each worm takes particular care to fortify the pannels of his own apartment, by hanging up his spoils there. The apartment contiguous to it, receives the like augmentation. I have sometimes found seven or eight of these skins hung one over another; in-somuch, that all the apartments being thus lined with six or seven of these old skins on one side, and with as many on the other, all well dried, and cemented with a tenacious glew, the whole structure grows daily stronger and stronger by duration.

Chew. But, Sir, this circumstance seems to be attended with a manifest inconvenience; for such a number of skins may happen to be glew'd one over another, as that in process of time they'll render the apartment too scanty and contracted.

Prior. Your objection seems very reasonable; and I must refer you to his Lordship for a proper solution.

Count. In this case, Sir, the bees alter the property of these cells; they lodge their young where before they stored their honey, and déposite their honey where they once lodged their young; at least this is the notion

tion of some very curious observers, tho' I will not aver it to be absolutely fact. As to the rest, they know very well when it is proper to remove what they see is superfluous. Having thus given you a satisfactory account, I hope, of their skill in Architecture, I shall now proceed to give you some insight into their conduct and œconomy; and for that purpose, Chevalier, we must fix our eyes with attention on their magazines of wax and honey. The examination of their structure and use will, I am persuaded, be an agreeable amusement to you. In the first place then, they have the precaution.

Chev. I find, my Lord, we are unfortunately interrupted: The sequel of your discourse must be reserved for a more favourable opportunity. There are five or six Gentlemen just alighted from their horses in the court.

Count. Don't be uneasy, my dear Chevalier, we'll return immediately.

Countess. We need not be in a hurry; those Gentlemen must have their boots taken off; and notice will be given us when to wait on them. The Prior has shewn us the comb and the contents of it, but has not given us a sight of what is wrapped in that paper.

Prior. You know very well, my dear Chevalier, the cells in which the young are lodged: You have seen those likewise which contained the wax; and I have here, in this piece of white paper, a part of the honey-comb.

Chev. Must not something be done to the honey, Sir, before it is fit to eat?

Prior. No, Sir. 'Tis here in all its purity, and infinitely more agreeable than when it has been adulterated by human art——Do but taste it.

Chev. Nothing sure can possibly be more delicious! I don't wonder now, that authors, when they would acquaint us with something very agreeable, always make mention of honey.

Prior. Honey, Sir, was the Sugar of the ancients. But as we have such large quantities of our modern sugar brought us from the *East* and *West-Indies*, we make but very little use of the other commodity at present.

Countess. As I take it, Chevalier, you have something of the antient taste.

Chev. I'll assure you, Madam, I never knew what a honey-comb was before.

Countess. Be-wise, be wise then, Sir, in time. The Prior, you see, is ever the same, and gives a peculiar relish to what he does. When he leaves us, he'll find out some little cottage or another to catechize in; where he'll bestow his charity instead of honey.

Prior. I am proud that your Ladyship approves of my conduct. I shall always continue to give my instructions, and my honey too, where I think 'twill meet with a favourable reception. But charity is your darling amusement, Madam, and I am nothing but your agent, or purse-bearer.

Count. These little animals, whom we find so sociable in their republick, embrace every opportunity of being serviceable to one another, and supply their mutual wants with the most surprizing beneficence; and shall we behold our fellow-creatures in poverty and distress, and contribute nothing to their relief? Alms-giving, Doctor, is, in my opinion, of all pleasures the most exquisite and refined; and whilst the good Providence of God shall vouchsafe to bless me with the good things of this life, I shall think myself highly ungrateful, should I see an indigent neighbour sinking under the weight of any calamity whatever, and not use my utmost endeavours to preserve him. But let us be gone. The company will wait for us.

B E E S.

Their History continued.

DIALOGUE VII.

The Count and Countess, the Prior, and the Chevalier.

Count. **R**emember, Gentlemen, we are now to take a survey of the two great manufactures of wax and honey.

Chev. As you have view'd them both, Doctor, pray inform me, in the first place, what this wax is.

Prior. The bees have two sorts; one coarse, and the other fine. The * first is of a blackish cast, and more like glew, or thick pitch, than any thing else: The other is a kind of fine rosin, of an odoriferous smell. This last they find about the numberless little grains which we see on the chives that arise from the bottom of flowers. As to their glew, 'tis without dispute the gum of some plants; but where 'tis they find it, I cannot absolutely determine.

Chev. To what use do they employ this glew?

Prior. When they have found a hive, or some other commodious retreat, their first care and concern is to stop up, with this glew, all the cracks and crannies, wherever they find them; and to amend such places as want the least reparations, in order to exclude the

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winds,

* Mr. Maraldi,

winds, and all insects that might otherwise incommode them.

Count. I'll give you an instance of this, within my own observation. Some few days ago, a snail made bold to steal into my glass hive. There was no private door for him to creep in at : However, he ventures to go in. The porters at the lodge gave him but a very scurvy reception : Their first salutations with their stings made him begin to mend his pace ; but the senseless creature, instead of making a retreat, march'd forwards into the very middle of the hive : Whereupon a whole band of them set upon him at once, and killed him upon the spot. Their greatest concern was, afterwards, how to get rid of the carcase. A council was immediately convened upon that occasion.

Chev. And I don't question but your Lordship understood all their debates.

Count. From first to last, Sir. The shrewd politicians amongst them argued thus : Should we propose to remove the carcase by dint of strength, the attempt would be vain and fruitless : The mass is too cumb'rous a load : Besides, the body is fixed to the floor of the hive by its own glutinous matter. On the other hand, to leave it where it is would be very incommodious, because it would be apt to putrify, and prove a delicious morsel for the worms ; and these worms, after they have regaled upon the snail, will most assuredly crawl up to the comb, and make havock of our young bees. The inconvenience they labour'd under was apparent ; and some expedient must immediately be found out to prevent it. You can hardly guess what stratagems they made use of to accomplish their designs. Pray, my dear Chevalier, give me your opinion on their dexterity and address. What measures, think you, were to be taken on this important occasion ?

Chev. Your Lordship bears too hard upon me, in starting so unexpected a question. By the sequel of the story, it will appear, perhaps, that the bees had more presence of mind than myself. But, pray, my Lord, how did they conduct themselves ?

Count. They cover'd the snail all over with this glew, and plaister'd it so thick, that no air could touch it. By
this

this device no insect could possibly lay her eggs in it, nor could any disagreeable steams perspire through the incrustation, whenever the carcase should turn to putrefaction.

Chev. Will your Lordship oblige me with a sight of the snail's tomb?

Count. Whenever you will. It wants nothing but an epitaph.

Chev. When the inside of the hive is well pitch'd, and the bees sufficiently shelter'd, how do they range their little apartments?

Prior. The foundation of the fabrick is laid on the top of the hive; there they make a bed of glew, to which they fasten the first chambers of their combs, which they carry on by proceeding downwards, and enlarging them, till they find there is no room left. The honey-combs are divided into three cantons, or districts; one, where they bring up their young; another, where they deposite their wax for their future use, as occasion shall require; and the third, where they treasure up their winter-stores.

As to the rearing of their young, I have nothing particular to observe on that topick, since they pursue much the same method as the wasps do. When the worm has burst its shell, the dam supplies it from time to time with honey. At the expiration of about ten or twelve days, when 'tis satiated, an old bee comes and closes up its lodge with wax. The worm, in this retreat, is transform'd to a nymph, and the nymph to a bee. After about fifteen days repose, the young bee breaks down her waxen inclosure; and after she has dried her wings, takes her flight into the fields, robs every flower of its hoarded sweets, and knows, without instruction, every circumstance of her future department.

As to the structure of the wax, I shall refer you to his Lordship, who has been more curious in his observations thereupon than ever I was.

Count. This particular, I confess, has been one of my favourite amusements. The wax, in one sense, is as necessary a provision for them as the honey itself. With this they build their cells, and not only close the apartments of their nymphs with it, but those too

wherein their honey is treasured up. When any casualties happen, any reparations are to be made, or the species multiply too fast, they have immediate recourse to their wax; and for that purpose, they take care to have a considerable stock of it always in reserve. They search for it upon all kinds of trees and plants, but particularly the rocket, the single poppy, and, in short, on all sorts of flowers in general. They collect it in their hair, with which their whole bodies are plentifully cover'd over. 'Tis something very agreeable to see them roll in the yellow dust that falls from the chives to the bottom of the flowers, and then return invested with those very grains. Their best method, however, of collecting this wax, especially when there is no great quantity of it to be found, is to carry away all the little particles of it with their jaws and fore-feet; to press them hard, and form them into little balls, and then slide them one after another, with their middle feet, into a cavity or bottom in their hind-feet. This cavity, like a spoon, receives the wax; and the hair with which their feet are cover'd serves to keep their burden steady, and secure it till they get home. They are sometimes incommoded in this work by the agitation of the air, the delicate contexture of the flowers, which bend under them, and hinder them from packing up this booty. In this case, they alight on some solid body, where they squeeze the wax into a mass, and wind it round their feet, return to the flowers time after time for fresh supplies, and when they have furnish'd themselves with a sufficient load, make all the haste they can to their respective apartments. Tho' two men could not collect so much as two little balls of wax in a whole day, yet a bee will amass that quantity, and carry it home in one journey. Such as gather the wax from flowers have proper assistance; for there are attendants ready at the hive-door, on purpose to ease them of their loads, as soon as they arrive; to brush their feet, and shake the balls out of them. Whereupon the former repair to the field again, in order to collect new stores; whilst those who help'd them to unload, convey their charge into the general magazine. I have observed however, that some bees, upon bringing their burden home, have convey'd

it to one of their apartments, and there unloaded it themselves, laying hold of it with their hind-feet, and with their middle-feet sliding it out of the cavity wherein it was contained. This, indeed, was apparently a work of supererogation, and what not one of them is under any obligation to perform. These little balls lie some few moments in the cell, till some new-commission'd officers come in to knead this wax, and spread it out with their feet, into different lays, heap'd one upon another. This is the unpolish'd wax, which we may easily perceive to be the produce of divers flowers, by the variety of colours that are visible in every lay. Afterwards, when they come to manufacture it, they knead it over again, purify and blanch it, and make it all of a colour. They are very frugal in the use of this wax. One may easily observe, that the whole clan is inspired with uncommon prudence, and that each member is under the strictest regulation. They are allow'd every thing that is necessary, but nothing that is superfluous: Not the least grain of wax is thrown aside or neglected. If they happen to make any waste, they are frequently employ'd in searching out for more, even when they want to lay up their provision of honey. For instance, when they open these cells where their honey is deposited, they take the wax with which those holes were stop'd up, and carry it into the magazine. I'll give you one instance more of their good œconomy: When a young bee has disengaged itself from its confinement, by breaking down the waxen partition which enclosed it, two old bees immediately come to the place, carry away all the remains, repair the lodge of the cell in a substantial manner, and convey into their reservoir all the little particles of wax that lie scatter'd round about it. Thus you see, Sir, there is nothing lost.

Countess. This œconomy of theirs is much of a piece, I presume, with your Lordship's account of the debates concerning the snail. All the ingenuity that I so much admire in their proceeding, flows only, I fancy, from yourself.

Count. I have often, when I have been in the humour, supplied them with such a train of reasoning: The same Divine Wisdom that gave these animals their

existence, has in reality enabled them to act with as much consistence for their welfare and preservation, as if they were rational beings. And as to their good conduct and œconomy, you yourself, Sir, may be an eye-witness of it, whenever you think convenient.

Chev. Now, my Lord, as to the honey. Will you be so good as to tell me what it is, and in what manner it is collected?

Count. The antients were of opinion, that honey was an efflux of air, a dew that fell upon the flowers, as if by appointment of Providence 'twas to descend upon nothing else. However, the moderns have discover'd, that dews and rains are of a quite different nature; that they wash the honey away, and hinder the bees from finding it. Honey is rather a perspiration of the finest particles of the sap in plants, which evaporate through the pores, and afterwards condense on the flowers; and as these pores are more open when the sun shines warm, than at other times, so the flowers are never more replenish'd with a viscous and vermilion juice, neither are the bees ever more gay and sprightly, than when the sun shines in its meridian lustre. Moreover, I conclude that the season has proved propitious; because violent rains either carry away the best salts from the soil, or dilute its purest juices; as, on the other hand, a long tedious dry season hinders those juices from flowing into the plant.

Chev. Since we know what honey is, methinks we might collect it from the flowers ourselves.

Count. Doubtless the thing is practicable enough, if you have but a trunk, or instrument proper for the purpose. Try and make one; you know I shew'd you a couple yesterday.

Chev. I am convinced of the folly of my reflection, and justly deserve to be rallied for it. Every one should act in their own sphere. 'Tis my province, for instance, to eat the honey, and that of the bees to make it. But pray, Sir, do they actually make the honey, or do they only extract it from the flowers, and so convey it home?

Frior. Your question is very pertinent, and deserves an answer. For my part, I am of opinion, that the bees make no manner of alteration in the honey, but collect

collect this delicious syrup just as nature has produced it; first fill their bags, and then discharge it into the magazine.

Count. I agree with you in that particular, and never observed that they were able, notwithstanding *Virgil* maintains the contrary, to give that honey which is too liquid, a consistence. It may possibly be true; but all that I could ever learn with respect to honey, amounts to no more than this, that the bee extracts it with its trunk, and discharges it when he arrives at that part of the comb, which is reserved for that particular purpose: And when all the cells are full, and some of them are closed up with wax, as a reserve for winter, and the others are left open, that each member of the community may resort thither at pleasure, and take a modest refreshment.

Chew. The bees, to our shame be it spoken, are much more temperate and regular than we are.

Prior. A hive is a school, to which too many of the human species ought to be sent. Prudence, industry, love of our neighbour, zeal for the publick good, œconomy, neatness, temperance, and, in short, all the virtues are conspicuous in the bees; or, to speak more properly, they read us lectures on those moral subjects.

Count. What charms me most is, to see these little animals influenced by that social spirit which forms them into a body politick, strictly united, and perfectly happy. They all toil for the publick good. They are all obedient and submissive to the laws and orders of the community. They have no sinister views, no distinctions, but those which nature, or the emergencies of their little state, have introduced amongst them: We never find them restless and uneasy; inclinable to abandon their hives, to take dislike at being slaves, and in a necessitous condition. They imagine themselves in a state of perfect freedom, possess'd of all the enjoyments of life; and in reality they are so. They are free, because they have no dependance but on their laws. They are happy, because the concurrence of their joint endeavours produces an affluence, which constitutes the riches of each individual. If we compare human societies with this, we shall find them all appear entirely monstrous. Necessity, reason, and philosophy, have formed them
under

under the laudable pretence of doing mutual good offices. But a spirit of self-interest destroys all; and one half of mankind leave the other indigent and naked, that they may indulge themselves in all sensual enjoyments.

Prior. As long as men are not influenced by the spirit of God, they are doubtless of all animals the most degenerate and corrupt.

Count. I can't tell how to express my concern and resentment, when I see how shamefully our species degrade themselves by that inordinate ambition, in particular, of aggrandizing themselves, and living in affluence and ease, without shewing the least compassionate regard for the necessities of their fellow-creatures. Here let us close this shocking scene; and tho' we find an absolute condemnation of our manners by the conduct of these little animals, who live in such uninterrupted peace and unity, yet let us proceed in our enquiries after them. 'Tis a subject that I am infinitely fond of. I have seen, Doctor, at your house, a glass-hive, wherein you have told me several times you have had a swarm of wild bees. Pray oblige us with a short account of them.

Prior. As I was sensible that your Lordship had made so many curious observations on the domestick bees, I made it my province to view with attention such as were * wild, in order to discover the difference. These insects, which are for the generality distinguish'd by the denomination of drones, or hornets, are more indolent, and nothing near so regular in their conduct as the common sort of bees. They are more incurious, and more negligent in regard to their habitations; and their work, in short, in every individual circumstance, falls vastly short of that delicacy which is so conspicuous in that of the other species. However, even their operations have their beauties. Their nest consists of dry leaves, intermingled with wax. This nest, which is situate for the generality in some hole, first dug in the earth by a field-mouse, is well arched over, or vaulted, in order to secure it from the injuries of the weather, or the accidental falling-in of the ground upon it. They work in my glass-hive, after the very same manner as they

they would have done, had they built their habitation in the fields. The principles of their architecture are unalterable. This nest has a thousand little holes in it, and appears much like a sponge; insomuch, that you may see with ease all that is transacted within doors. Every hornet erects with wax a little lodge, or apartment, about the size of a large pea, cut in two through the middle, round, and hollow like half an egg-shell. From these several cells, united together, arises a kind of cluster, which strikes the eye agreeably enough. The females, whose number amongst the wasps and bees appear, as we have before observed, but very inconsiderable, lay about nine eggs in the open lodges; after which, the other hornets close them up with wax: When they have so done, they stand upon the covering they have made, and are there in a perpetual motion, with intent either to give warmth to those eggs, or at least to prevent the cold from having any influence over them. When the worms have once quitted their eggs, their first efforts are to break down the doors of their respective lodges. The hornets without lend them their friendly assistance, by rubbing and mollifying the wax: Soon afterwards, a large hornet makes its appearance, and devours the whole waxen covering.

Cher. What, Sir, does he subsist on the wax?

Prior. No, Sir, but he melts it in his stomach, which is very hot, and then he makes use of it in the execution of some other work. The worms, thus hatch'd, fall immediately into violent agitations, which throw their whole bodies into a sweat; and that moisture which perspires through them, forms a glew, which condenses by slow degees, and becomes a little white skin, with which they are immediately enclosed. This is their state of nymphs. In this state of inactivity they look like so many grains fasten'd to one another, and which form in the whole a little cluster. After this, out of every nymph's shell issues forth a little hornet, who begins to rub his eyes with his fore-paws. His wings, that are still spread upon his back, and wet, grow dry by degrees in the air: In a quarrer of an hour, he finds himself at perfect liberty, and ranges through the fields at random with those of his own age. They are indulged

indulged for a short time. All the young hornets in general frisk about, and rise and set, just as they please for the three first days; but at last, by their little wanton tricks, grow troublesome, and interrupt the old ones in their work; who thereupon drive the little impertinents before them, and oblige them to settle. The young ones, thus chastised, wheeling several times round about, like creatures intoxicated, begin to work as well as the rest, and carry earth to the nest, for the better support of the waxen lays which form the vaulted roof. This earth is cemented, and spread abroad by a retrograde motion of their bodies over it. 'Tis the old ones that work upon the wax, and the young ones attend them, in the capacity of masons servants.

Chev. Have not these hornets a king, or a queen, as well as the domestic bees?

Prior. I have frequently observ'd, amongst those I have in my hive, one particular hornet, much larger than any of the rest, without wings, or the least hair about him; as bare, in short, as a pluck'd fowl, and black as jet, or the most polish'd ebony. This king takes his tours from time to time, and surveys the whole fabrick. He enters into all the lodges one after another, in order, as we presume, to take their exact dimensions, and to see if the work be compleated with beauty and proportion.

Count. I hope you'll excuse my freedom; but I am apt to think you are in the wrong, and that this royal surveyor of yours is a queen, who visits those lodges in the manner you mention, with no other view than to deposite her eggs in such as are empty.

Prior. I readily acquiesce, and freely acknowledge your Lordship to be the more accurate observer. However, with your Lordship's permission, I proceed to give you a detail of what I imagine I have seen; and if ever I advance any thing that may possibly lead the Cavalier into a mistake, I hope your Lordship will set us right. When this queen then makes her publick appearance, all the young hornets, who form her court, plant themselves in a circle round about her, clap their wings, raise themselves on their fore-feet, and after several springs, and other expressions of their joy, attend

tend her throughout her progress : At the close of which her majesty withdraws, and all her retinue return to their respective employments. These wild insects, however, are not near so vigorous, or intent on their labours, as the domestic bees. The young hornets are remiss, and indolent in a morning ; and 'tis with some difficulty that they are prevailed on to settle to their work : But in order to animate them thereto, one of the most corpulent of their band, exactly at half an hour after seven, erects his head, and part of his body, out of a box or stand contriv'd for that purpose, situate on the most elevated part of their habitation ; there he claps his wings for near a quarter of an hour, and makes such a noise, that he awakens all the inhabitants. This is their call to work, and the drum that beats the signal for their march. There is likewise another officer, who keeps guard all day ; and I have seen him discharge his duty with such activity and vigilance as has surprized me. When I have given the hive a sudden shock, the centinel has immediately quitted his box, and with all the marks of hurry and confusion, mounted to the top of the roof, prying into every creek and corner, to find out, if possible, the cause of the alarm ; And after he has been fully convinced that there was no danger, nor enemy to invade their territories, he has returned to his former post with seeming alacrity and satisfaction. For my amusement, I have thrown a common bee, after I have pulled off one of his wings, into their hive ; upon which the centinel has immediately enter'd into an engagement with him, and laid him dead upon the spot.

Chev. This is a confirmation of what *Virgil* tells us, with respect to these insects keeping a constant guard. But pray, Sir, favour me with some account of their provisions.

Prior. Their food is honey, indeed ; but then 'tis nothing near so fine and delicate, as that of the domestic bees ; for they extract it from wild flowers, whose juices are much more bitter than those which grow in gardens.

Chev. Do they lay up any store of provisions ?

Prior. Yes, Sir, just as the bees do ; and make use of the cells from whence the worms proceeded for that
very

very purpose. They first fill them with honey, and then stop them up with wax. There is a pack of lazy indolent creatures belonging to their community, that are a perfect burden and incumbrance to it, and 'tis very probable, that this precaution is used upon their accounts.

Count. But pray, Sir, in what particular could you discover their indolent deportment?

Prior. In this instance, my Lord. When the rest of their companions have been employ'd abroad, I have taken notice that this idle band have saunter'd about, and kept within a small distance from the hive; have put on, indeed, an air of doing something, and then have returned home, and filled their bellies, tho' the work they did was very immaterial.

Count. Excuse me, Doctor, but I imagine you are mistaken in your notion of these sluggards. These appear to me to be the males, as there are drones amongst the bees; and they are provided for on account of their past services: When winter, indeed, comes on, they are dismiss'd, in all probability, and obliged to provide for themselves elsewhere.

Prior. Your Lordship's notion, for aught I know, may be very just. For 'tis doubtless reasonable enough, that wild bees shou'd have their queen, their males, and a part of their community mules, of neither sex, as well as the domestic bees. This point, however, with submission, my Lord, requires farther examination.

Count. Pray, Doctor, proceed in your observations; for all this is a novelty to me.

Prior. Alas! my Lord, my observations are all over. For a sad disaster attended us.

Count. What might that be, pray?

Prior. About four days ago, our queen set out on her progress by break of day, and proceeded, infirm and old as she was, with a trembling march, to the confines of her dominions. I saw her majesty drop down behind a little eminence; and after having languish'd a short time

Chew. What then?

Prior. She instantly expir'd

The whole city was inconsolable on the occasion. The drum did not beat the signal that morning as usual.

A heavy

A heavy melancholy sat on every brow. In short, there was an universal dejection.

Chev. Methinks I sympathize with the poor creatures. But what was the result of this unhappy loss?

Prior. There were great commotions immediately in the state. Ever since, the number of the inhabitants has daily decreased, and one family or other has been constantly removing in search of a more agreeable settlement. The day before yesterday, there was a very sharp engagement; and one hornet, more resolute and forward than the rest, had his head sever'd from his body: I saw him my self run to the top of the dome without it, and there he lived in that bloody condition till this very day. There was no order observ'd, no signal given in the morning, no centinel appeared, and, in short, the whole city was in an uproar and confusion.

Chev. I can't say I am any ways concerned for the execution of that malefactor. Methinks he makes a grotesque figure.

Prior. All the measures of my hornets are, in short, quite disconcerted; and I very much question whether there are ten left in the hive. If the Chevalier pleases, I'll shew him the structure of the nest.

Count. Do so: But take care you are not stung. After examination you may make him a present of it. 'Twill contribute as well as your wasp's nest towards the embellishments of his closet.

Countess. Gentlemen, tho' you have given us a sufficient detail of the industry of bees; yet you have not sufficiently expatiated on the use which is made of their labours. Pray, Doctor, what may be the intrinsic value of a hive of bees?

Prior. If the seasons prove regular, a hive may be worth a pistole, or something better one year with another. In case there should be two swarms, the profits will be double the next year, notwithstanding you should suffocate the first bees with sulphur, in order to take their wax and their honey from them. 'Tis not customary to let them work above seven years; because they then grow infirm, and their labours lie open, and expos'd to the depredations of the worms and moths, who find out ways and means before that time to steal privately

privately into their apartments. I shall not, however, enter here into a detail of the best methods for the regulation of bee hives; since every common gardener can lay down proper instructions on those occasions: Neither shall I expatiate on the various uses of virgin-wax, as we have it from the hive without adulteration; or of that other sort, that has been wash'd, melted down, and expos'd at proper times to the dews and the sun, in order to make it white; since they appear daily in various forms, as flambeaux, tapers, images, and a thousand other things that are obvious to the observation of all mankind.

The fattest and most luxuriant grounds don't always produce the purest honey; there are some dry or barren soils, whose fruits and fowls, both wild and tame, and in short all their other productions in general, are superior to any other, not only with respect to the delicacy of their juices, but their flavour. There it is, that honey is to be found in its utmost purity and perfection. Such, for instance, is the land all round about *Corbiere*, some few leagues distant from *Narbonne*, and a considerable part of *Champagne*. The honey of these two countries is in the highest estimation. There is one particular which is very remarkable in those cantons of *Champagne* which are nearest to the rivers, and are richer than any [of the others]. The bees make long excursions into the adjacent countries, and prefer the flowers which they meet with on the poorest lands before their own. A gentleman who lives not far from the river *Aine*, and with whom I travelled one day accidentally from *Chalons* upon the *Marne* to *Charleville*, oblig'd me and his company with this observation. We were near a league and a half from his estate, which lies in the vale, on the edge of the flowry meadows of *Attigny*. As we pass'd along we met with nothing but heath, and could discover no village within three miles round about us. Gentlemen, do you take notice, said he, (shewing us a crop of buck wheat that regaled our noses with a very agreeable odour) Do you see my servants, who have dispers'd themselves about the country, and are all hard at work for me? Perceiving, however, that the company could not rightly comprehend his meaning;

meaning; why, Gentlemen, continued he, the whole mystery is this. Those bees which you see yonder hovering round the flowers, come hither, tho' their hives, or settlements, are at least three leagues distant. We see them every day abandon our gardens, and contemning the oil and other rich products of our valleys, take their flight to the mountains and plains of *Champagne*, where they find thyme, lavender, buck-wheat, sweet-marjoram, and divers other plants, which, tho' little or no care be taken in their cultivation, are very juicy and delicious. You will find a considerable number of bees all the way from hence to my estate, and some gentlemen who are curious in their observation, will peremptorily assert, that they have seen them take a journey, thrice in one day, of a league and a half, and sometimes two leagues from home, in order to furnish themselves with such provisions as are most agreeable to their taste.

Countess. Chevalier, these Gentlemen engross the whole conversation to themselves. But methinks you and I, Sir, as poor as we are, should, for our honours sake, contribute something towards our next conference.

Chev. For my own part, I have already made my application to the Prior, who has a whole magazine of curiosities at home; for which reason I don't question but I shall be furnished with materials enough to answer my share, or proportionable part in our next entertainment.

F L I E S.

DIALOGUE VIII.

The Count and Countess, the Prior, and the Chevalier.

Countess. **P**RAY, Gentlemen, before we begin, let us know how rich we are, and what each member contributes towards this day's entertainment.

Count. I propose to produce a *Fly* and a *Gnat*.

Prior. And I a *Grilla-talpa* and an *Ant*.

Chev. And I the *Formicaleo*, an inveterate enemy to the whole race of *Ants*.

Countess. Since here are materials enough for one day's conference, I'll reserve my little stock for another opportunity.——Poor folks, you know, ought to be good economists.

Count. Well then! We'll begin with the common fly.

There is scarce any species of this insect, how weak and despicable soever it may seem at first view, but what is possessed of five or six natural endowments, which are of singular service upon all occasions: For instance, it has two fine eyes, two horns and a trunk in its head, a pair of wings on its back, several little claws and sponges upon its feet, and a piercer in its tail.

The eyes of this little animal, like those of beetles and dragon-flies, are of a particular structure. They consist of two little half moons, or immoveable pads planted

planted all round the head of the insect, and compos'd of an infinite number of little eyes, or minute chryſtal-line humours rang'd in croſs lines, like lentils, much after the ſame manner as a piece of lattice-work.* Under theſe the very ſame number of fibres, or optic nerves, are to be diſcern'd, as there are facets or planes without: And ſome curious naturaliſts aver, that they have counted ſeveral thouſands on each ſide.† But be that as it will, 'tis certain, that all thoſe facets, or ſmall partitions, are ſo many little eyes, whereon external objects are painted as on ſo many ‡ mirrors. There we may plainly perceive the form of a lighted taper, multiplied almoſt to infinity; there we may diſcern it dart upwards and downwards into each eye, according to the motion it receives from the hand of the obſerver.

Chev. To what purpoſe has nature beſtow'd on them this profuſion of eyes? All other creatures, for the generality, are perfectly ſatisfied with two.

Count. The eyes of other animals are multiplied, if I may be indulg'd the expreſſion, by their various caſts or glances, on different objects; but the eyes of a fly are immoveable; and can only diſcern thoſe things which lie directly before them. For which reaſon, they are multiplied in the manner before-mentioned, and rang'd, ſome higher, and ſome lower, on an orbicular ſurface, to give the fly timely notice of every thing wherein her intereſt is concern'd. She has many enemies; but by the aſſiſtance of thoſe eyes, ſo planted all over her head, ſhe can ſee at once when any danger attends her before or behind, on one ſide or the other; and the ſame object is diſcern'd as diſtinctly by that multiplicity of eyes, as it would be by any other creature with only two.

The wings indeed, which transport this inſect from one place to another, and the claws, which fix her in ſuch a ſituation as is moſt agreeable to her, are no other conveniences than what are beſtowed in common on moſt

* Leeuwenhoeck, Arcan. Nat. Tom. 3. Ep. 111. Nieuwentit Exiſt. liv. 2. c. 7.

† Eight thouſand at leaſt, according to Leeuwenhoeck's Experiment, and Contemp. Ep. 83.

‡ Leeuwenhoeck, ibid.

most other flying insects : She has one advantage, however, above most other minute animals, and that is a packet of sponge placed below at the juncture of her claws. When this little creature walks upon any polish'd body, wherein there is no possibility of fastning her claws, she treads upon her sponge, and from thence expresses a kind of glew, which tho' tenacious enough to keep her from falling, does not retard her intended progress. Besides these sponges, her legs are invested with hair, which she makes use of instead of a brush, for the cleaning of her wings.

Chew. I have been several times highly delighted with her performance of this particular exercise. In the first place, she cleans her brushes ; then she rubs one paw against the other ; and after that, draws both of them first over, and then under her wings. The last use she puts her brushes to, is the cleaning of her head. But I can't conceive why she should repeat this operation so often.

Prior. She has a natural propensity to cleanliness. Besides, she is conscious, that unless she was very careful in this particular, not only the dust and smoke, to which she is frequently expos'd, but the rains and dews which sometimes fall upon her, would prove an incumbrance on her wings, and a fatigue to her whole body.—But I beg your Lordship's pardon for this interruption.

Count. Her trunk consists of two parts, one whereof folds over the other, and both are sheath'd within her mouth.

At the other extremity of her body she has an * auger, of above three twelfths of an inch in length, with which she pierces through what she sees convenient, and then sheaths it under her scales. This implement is compos'd in the first place, of divers parts : As for instance of one or two saws, sharply pointed and indented all along : Secondly, of a long case to enclose them : Thirdly, of several strong muscles to dart them out, and divers fibres to retract them as occasion requires : And lastly, a bag of corrosive water, in order to eat
into

* Leeuwenhoeck's Arcan. Nat. Tom. 3. Ep. 136. and Tom. 2. Ep. 64.

into such hollow places as have been first opened by the saws.

The fly makes use of this auger, to prepare a convenient lodgment for her eggs, and makes choice of such leaves as are most lacteous and juicy, and such as are not too salt; because the saline particles are rather apt to lacerate the tender organs of their young ones, than to nourish and support them. From their eggs proceed several little worms, which are afterwards transformed to nymphs, and then to flies. I shall not here enlarge on the ill consequences of their prodigious fecundity, but shall content myself with barely observing, that not the mouth of a lion, the jaws of a wolf, or all the horns and fangs of the wildest beasts, in their united fury, are half so injurious to mankind, as that little auger of a common fly. The case is quite otherwise with respect to *Ichneumon* flies, and some others of a different species, which are rather of service than any ways pernicious. Most of these insects support and secure themselves in some favourite plant; and 'tis to their natural propensity to deposite their eggs in them, that we owe our invention, as well as the materials of the finest colours, made use of in dying and painting, our deepest black, our common ink, our scarlet, vermillion, &c.

Countess. 'Tis the general notion that our ink is made of vitriol and gall-nuts, gathered from the oak; and that in the dying of scarlet, the principal ingredient is cochineal, which is nothing more than the grain of an *Indian* tree; so that for my part, I can't conceive how the *Ichneumon* fly, or its piercer, can possibly be of any service in these respects.

Count. 'Tis this. There is one particular species of flies * that make choice of the oak, before any other tree, to deposite their eggs in. With that implement, of which I have just given you a description, they first penetrate to the heart of a leaf, and often to the bud itself, whilst it is tender, and then with their saw pierce through to the very pith. At the same time she sheds one drop of her corrosive water into this cavity,

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and immediately deposits one or more of her eggs in it. The heart of the bud being thus wounded, the circulation of the nutritive juice is interrupted, and the fermentation thereof, with the poison injected by the fly, burns the parts adjacent, and there alters the natural colour of the plant. The juice or sap, turn'd back from its natural course, extravasates and flows round the egg: After which it swells and dilates by the assistance of some bubbles of air, which get admission through the pores of the bark, and which run in the vessels with the sap. Its coat is dried by the external air, and grows hard, in a figure which bears some resemblance to the bow of an arch, or the roundness of a kernel. This little ball receives its nutriment, growth, and vegetation, as the other parts of the tree, by slow degrees, and is what we call the gall-nut.

The worm that is hatch'd under this spacious vault, finds in the substance of the ball, which is as yet very tender, a subsistence suitable to its nature; it gnaws and digests it till the time comes for its transformation to a nymph, and from that state of existence to a fly. After which, perceiving itself duly provided with all things requisite, it disengages itself soon from its confinement, and takes its flight into the open air.

The truth of this account may with ease be demonstrated. View but with attention those gall-nuts which grow in the beginning of the summer, and you'll immediately perceive that they have been pierced through; because the warmth of the season has advanced the egg, the nymph, and the fly. If in opening them you should happen to meet with a young spider, don't imagine it to be the product of a fly's egg; for notwithstanding she abandons the gall-nut, yet the place is still serviceable on some other occasion: A small spider, for the generality, steals into the cavity, which is a commodious retreat, prepar'd for her without any trouble or fatigue. There she spins her thread, in proportion to the dimensions of the lodge; and then ensnares all such diminutive insects as presume to approach her new habitation.

The case, however, is not the same with respect to the gall-nut that grows in autumn. The cold weather frequently comes on before the worm is transform'd into a fly,

ly, or before the fly can pierce through its enclosure. The nut falls with the leaves; and altho' you may imagine that the fly which lies within is lost, yet, in reality, it is not so; on the contrary, her being covered up so close is the means of her preservation. Thus she spends her winter in a warm house, where every crack and cranny of the nut is well stopt up; and lies buried, as it were, under a heap of leaves, which preserve her from the injuries of the weather. This apartment, however, tho' so commodious a retreat in the winter, is a perfect prison in the spring. The fly, rouz'd out of her lethargy by the first heats, breaks her way through, and ranges where she pleases. A very small aperture is sufficient for her; since at this time she is but a diminutive creature herself: Besides, the ringlets whereof her body is composed, dilate, and become pliant in her passage.

Chev. From what your Lordship has asserted, I can plainly perceive the reason why a worm is often found under the hard shell of a small nut, or a filberd. I am now fully convinced, that it proceeds from an egg which some fly has deposited there whilst the fruit was very tender; and we may always discern the puncture which the fly had made with her auger.

Count. If this orifice should close, as it does in fruit, pease, and beans, the reason is, because the flow of the sap into the wound stops it up by degrees. There the worm, as soon as she breaks through her enclosure, finds under the roof or vault of the kernel, or in the heart of the fruit, a retreat, where there is nothing to incommode her, and a stock of provisions, to which no rival will ever contest her title. There she works with her teeth and her feet, entirely at her ease. There she lives in affluence and good case, till finding her wings perfectly disengag'd, the natural love of liberty and diversion prompts her to break through her confinement, and sally out in quest of new company and provisions.

Chev. You make a smart personage of this little hermit.

Countess. By this explication of the origin of the gall-nut, your Lordship has cleared up a difficulty that very much embarrass'd me. I was at a loss to know whether the oak, which bears the acorn, did not likewise produce

another fruit of a quite different nature. I am now satisfied, however, that these gall-nuts are excrescences only, created by the puncture of an insect.

Count. They are term'd gall-nuts, without any just grounds for that denomination. It must be acknowledg'd, indeed, that they have something which bears a near affinity to a kernel, and is gathered from a tree. They have only a false appearance, however, of a nut or fruit, and are, in fact, neither the one nor the other. There is scarce any plant to be named, but what is liable to the punctures of some one insect or another, and that does not produce some of these imaginary nuts of divers colours, and of different sizes. Though there are some trees whose leaves abound with them; yet they are distinguish'd by no particular name, because they are appropriated to no manner of use: 'Tis possible, however, that such as grow upon the Plane-tree, the Poplar, the Willow, the Box-tree, or on an Ivy-bush, may be very beautiful with respect to their colour, were we inclin'd to gather them, and make the experiment.

Countess. Will not the same assertion hold as good with respect to cochineal, as to these gall-nuts?

Count. You have started a conjecture that deserves a serious answer.* Some travellers tell us, that 'tis the grain of a tree; when, at the same time, 'tis nothing but an excrescence. Others, that cochineal is, properly speaking, the dust that falls from a certain fruit; after it is grown to maturity. Others again assert, that 'tis rather a worm that lies buried in the heart of some little apples, which grow on the cochineal-tree. These serious conjectures, however seemingly inconsistent with each other, may be reconciled when we come to compare them with the truth. The cochineal-tree is pierced by an insect that deposits her eggs upon it; from whence arise several little tumours, which have been looked upon, though without any just reason, for actual fruit. There we find a red powder, which proceeds from what the worm has both gnawed and digested. There we find the worm itself, if we are but curious enough to watch the time when it pierces through the surface of such

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* Savari Diction, de Comm.

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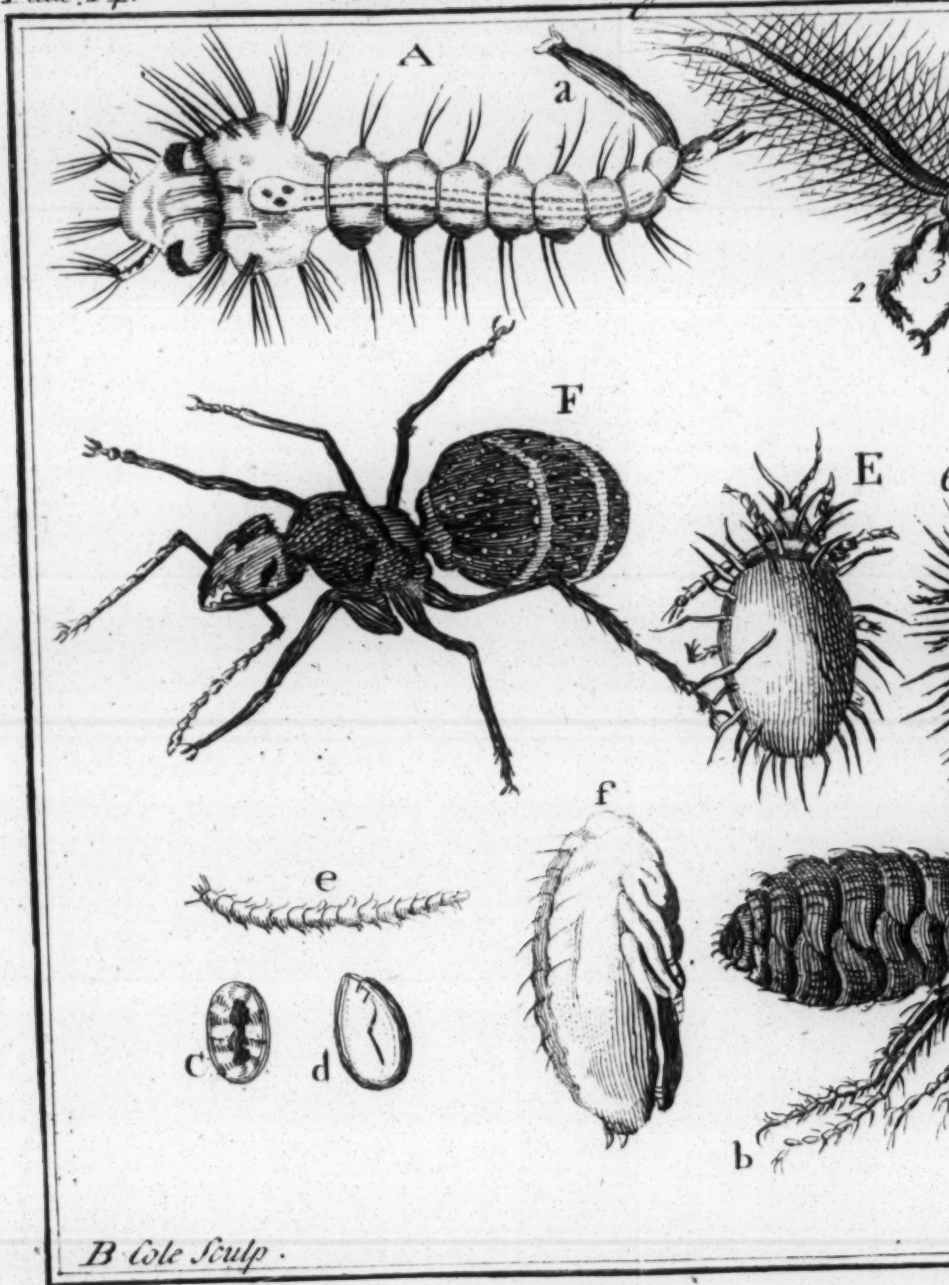
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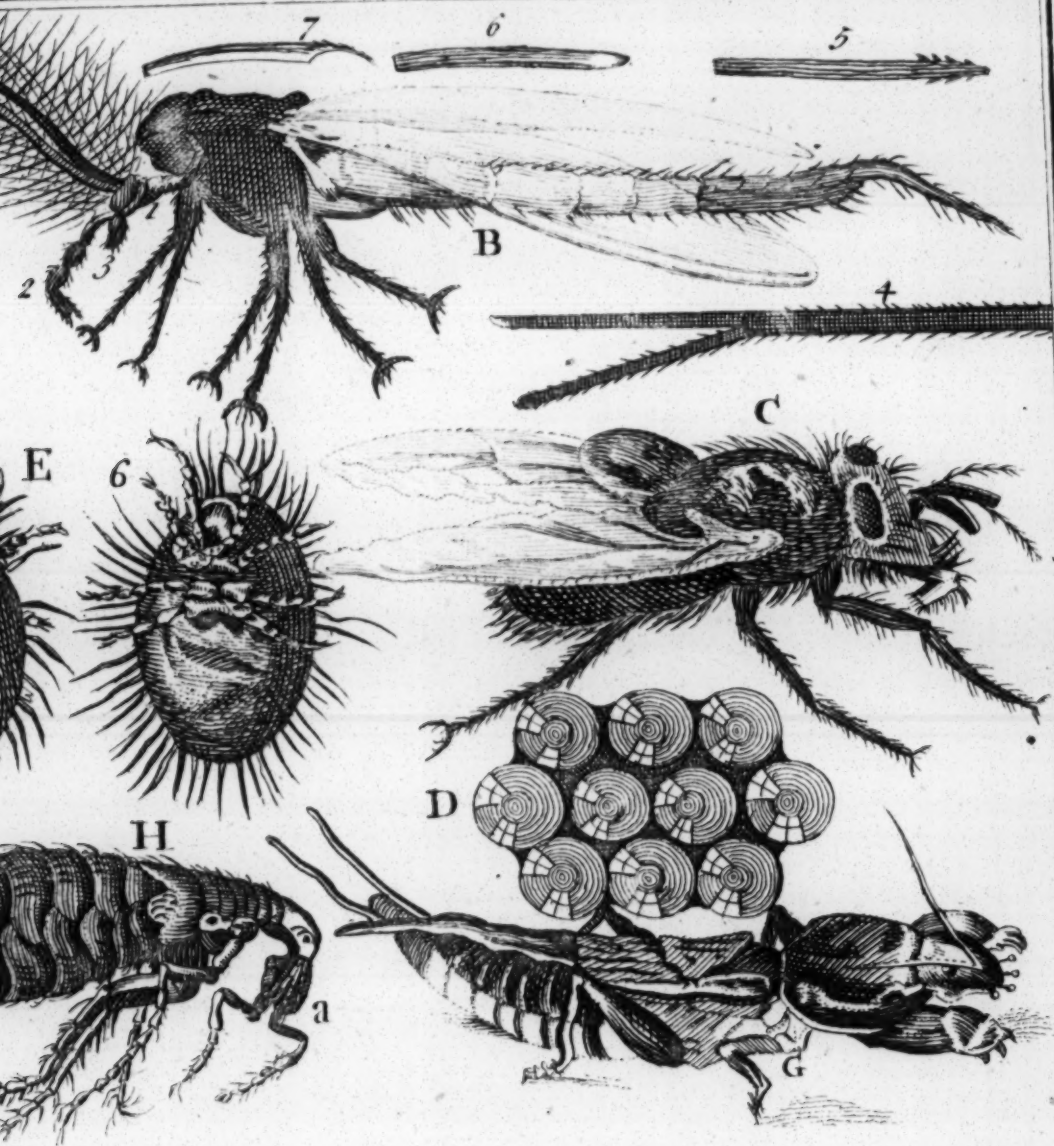
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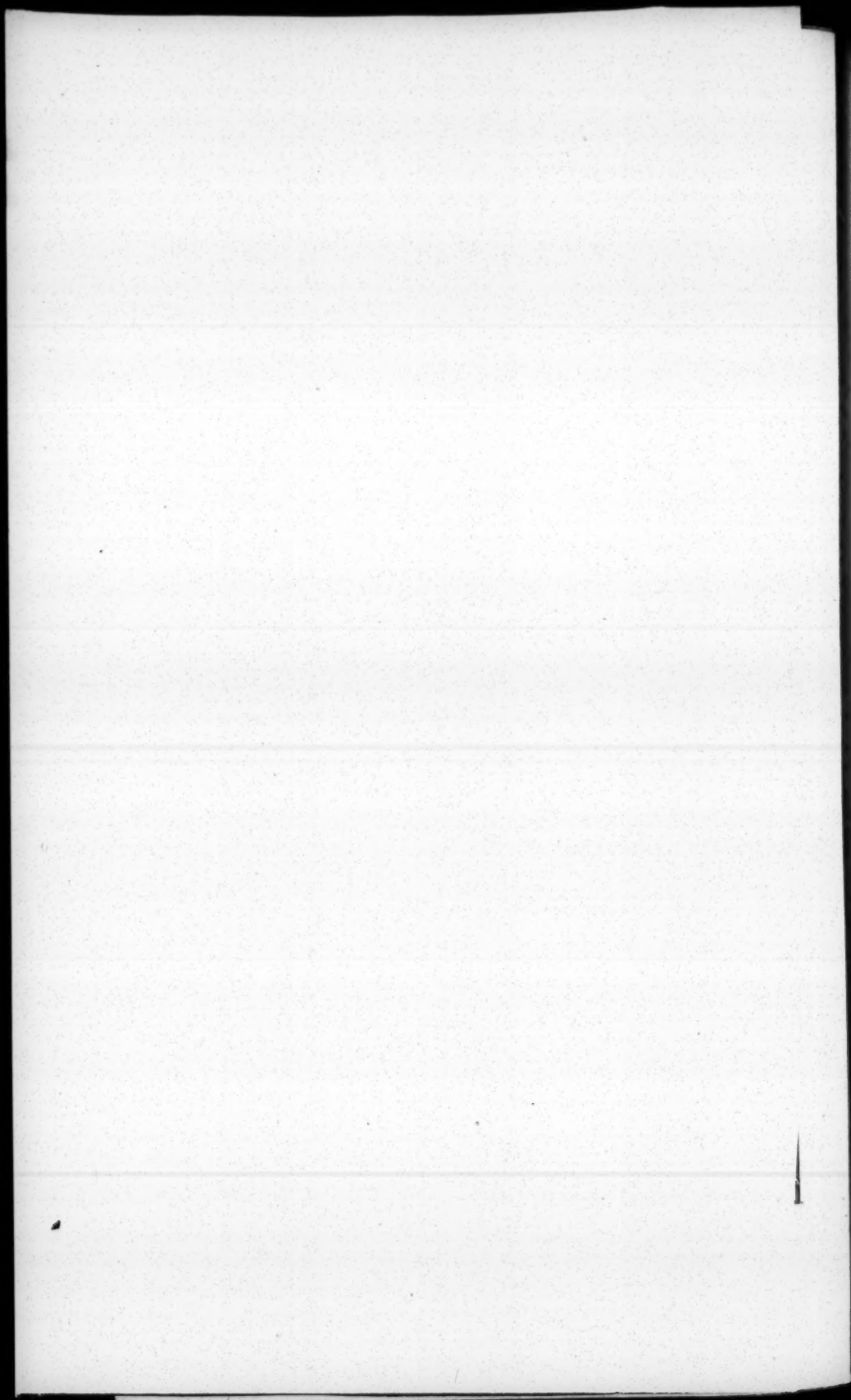
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excrecence.* The true vermillion, the best black, the kermes, and several other colours or drugs, have no other original than the puncture of different flies. They are to be met with, in short, on all our own plants; and 't's not improbable, but we send to the *Indies* for several commodities, of which we have a sufficient quantity here at home.

Chev. We are charm'd, my Lord, with your flies. Are your gnats, likewise, as curious in their kind?

Count. Though they are not, in all probability, such useful insects; yet their transformations are much more surprising. Chevalier, if you please, we'll take a tour along the mote of the castle. I have found here, hard by, the very thing we wanted. Stoop down, Sir, towards the root of that tree, which shoots into the water. Don't you see something upon the surface close by the root.

Chev. Yes, my Lord, something like a little sieve, which is fastened at one end to the stump.

Count. This † sieve is a small piece of glew, supported by the water, and the imaginary holes in it, are so many eggs, regularly placed on the glew, that they may not sink; and the thread which fastens it to the root prevents the whole from being transported by the wind to such other place as might prove too cold, and where the eggs, for want of proper heat, could not be hatch'd.

Chev. What animal, my Lord, is this, that is thus wise and wary?

Count. The gnat, Sir, or the midge, so well known by its buzzing, and its sting.

Chev. How! does the gnat, that lives in the air, and on the earth, deposit her eggs in the water?

Count. Have you not a hundred times observed gnats to hover about the surface of a pond? They are peculiarly fond of all standing waters, because 'tis there that they rear their young.—But I'll give you their history in a few words.

From these eggs, deposited on a lay of glew, on the brink of the water, proceed divers animalcula, which

* Memoirs of the Acad. of Sciences, Mr. Geoffroi. Jun.

† Hist. de Inf. par Swamm.

pass through three different states. In the first place, they live in the water : Then they change from being aquatic creatures, to such as are amphibious ; living sometimes in the air, and at others in the water ; and lastly, they are inhabitants of the air only.

They are aquatics in their first state ; and during that time resemble little worms, or vermin, that make themselves lodgments of glee, which they fasten to some solid body at the very bottom of the water ; unless by accident they meet with a piece of chalk, which being of a soft and pliant nature, gives them an opportunity of sinking a retreat for themselves, where nothing but the claws of a cray-fish can possibly molest them.

This worm afterwards changes its form. It appears with a large head, and a tail invested with hair, and moistened with an oleaginous liquor, which she makes use of as a cork, to sustain her head in the air, and her tail in the water, and to transport her from one place to another. When the oil with which her tail is moisten'd begins to grow dry, she discharges out of her mouth an unctuous humour, which she sheds all over her tail, by virtue whereof she is enabled to transport herself where she pleases, without being either wet, or any ways incommoded by the water.

The gnat, in her second state, is, properly speaking, in her form of a nymph, which is an introduction, or entrance to a new life : In the first place, she divests herself of her second skin ; in the next, she resigns her eyes, her antennæ, and her tail ; in short, she actually expires. However, from the spoils of the amphibious animal, a little winged insect cuts the air, whose every part is active to the last degree, and whose whole structure is the just object of our admiration. Its little head is adorn'd with a plume of feathers, and its whole body invested with scales and hair, to secure it from any wet or dust : She makes trial of the activity of her wings, by rubbing them either against her body, or her two side-bags, which keep her in an equilibrium. The furrow, or little border of fine feathers, which graces her wings, is very curious, and strikes the eye in the most agreeable manner.

There

There is nothing, however, of greater importance to a gnat, than her trunk;* and that weak implement may justly be deemed one of nature's master pieces. 'Tis so very small, that the extremity of it can scarcely be discern'd through the best microscope that can be procured. That part which is at first obvious to the eye, is nothing but a long scaly sheath under her throat. At near the distance of two thirds of it, there is an aperture, through which she darts out four stings, and afterwards retracts them: One of which, however sharp and active it may be, is no more than the case in which the other three lie concealed, and run in a long groove. The sides of these stings are sharpen'd like our two-edged swords. They are likewise barb'd, and have a vast number of cutting-teeth towards the point, which turns up like a hook, and is fine beyond expression. When all these darts are stuck into the flesh of animals, sometimes one after another, and sometimes all at once, the blood and humours of the adjacent parts must unavoidably be extravasated, upon which a tumour must consequently ensue; the little orifice whereof is closed up by the compression of the external air.

When the gnat, by the point of her case, which she makes use of as a tongue, has tasted any fruit, flesh, or juice, that she has found out; if it be a fluid, she sucks it up, without playing her darts into it: but in case she finds the least obstruction by any flesh whatever, she exerts her strength, and pierces through it, if possibly she can. After this, she draws back her stings into their sheath, which she applies to the wound, in order to extract, as through a reed, the juices which she finds inclosed.

This is the implement, you must observe, with which the gnat performs her work in the summer; for during the winter she has no manner of occasion for it; then she ceases to eat, and spends all that tedious season either in quarries or in caverns, which she abandons at the return of summer, and flies about in search after some commodious pond, or standing water, where she may rear her progeny, which would soon be wash'd away and lost by the too rapid motion of any running stream. The little brood are sometimes so numerous, that the

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* Leuwenhoeck's Arcan. Nat. Exper. and Con. Ep. 64.

very water is tinged according to the colour of the species ; is green, if they be green, and of a sanguine hue, if they be red.—Now, Doctor, 'tis your turn to give us a description of your *Grillo-talpa*.

Countess. *Grillo talpa* ! What a shocking term is that ! and how disagreeable to the ear ! at least 'tis so to mine. Why can't you give it some more easy and familiar appellation ? Is not this the animal, my dear, which lies in your closet, extended on a turf, under a glass cover. 'Tis about three inches in length, has two horns before and two behind, to give it information of all that passes in that dark cell wherein it resides. It has, moreover, a long tail, a pair of little, strong, short wings, and two arms, with two formidable saws.

Count. The very same.

Countess. If I am not mistaken, I have heard some people call it a *Mole-Cricket* ; because, like the mole, it lives under ground, and mimicks the chirping of a cricket. This now, in my opinion, is a much more familiar name for it.

Prior. The fair sex have a greater privilege than ours to make use of new terms. Her Ladyship's authority may be sufficient to establish this ; and we'll venture to introduce it.

Count. If you please, Doctor, we'll go to one corner of the parterre, and there we shall find a whole nest of these insects. There is nothing passes, you see, in this quarter, but what I have some intelligence of. Every animal here is at work for me —See ! here is the place.

Prior. Let us take a spade, and shew the Chevalier a piece of cemented * earth, in the heart whereof he'll perceive a small lodgment, capable of receiving about two filberds, where all the eggs are deposited. Let us open it carefully, that we may not break any thing. Take it in your hand, Sir : That is the very turf I was speaking of. 'Tis as large you see as an egg, and surrounded with a little trench. Cut it in two with your knife : You'll find the entrance into the apartment has been stopped up.

Chev. It has so.—What a number of eggs are lodg'd in this little apartment——Let me count them.—If I

reckon

* Godart.

reckon aright, there are one hundred and fifty.——
But why are they deposited there ?

Prior. Were those eggs cover'd with less care and circumspection, were they exposed to the least breath of air, they would be deprived of that warmth which is requisite to bring them to perfection : There would be no hopes of a future progeny. There is another reason why these mole-crickets are obliged thus carefully to close up the lodgments where they deposite their eggs, and to surround it with such a trench as before-mention'd, which is this : Because there is a little black animal, a profess'd enemy to their species, that crawls under-ground, and uses its utmost efforts to destroy either their eggs, or their young, as soon as hatch'd. One of the clan, however, is posted as centinel on the bank of the trench ; and when the black invader plunges in to seize his prey, he is instantly cut short, and, by that means, the whole community is preserved. In case the mole cricket, that thus keeps centry, find his enemies too numerous, he then takes the advantage of these winding-paths which you see are struck out under ground, and so makes his escape. There is, however, one piece of dexterity in the conduct of these animals, which is more remarkable than all the rest, and which we found out by the help of a glass-bell, under which we rear'd a considerable number of these insects, in a quantity of earth sufficient for our purpose.

At the approach of the winter-season, the mole-crickets carry away the reservoir in which their eggs are contain'd, and sink it so deep into the ground, as that the frost can have no influence over it. As the weather grows milder, they raise their magazines in proportion ; till at last they bring it as near to the superficies as is proper, in order to receive the impressions of the refreshing air, and the benign influence of the sun ; and in case the frost returns, they sink it again to its proper depth. The same precaution is observ'd by the ants, to whose history I shall now proceed, as I have nothing more material to acquaint you with in respect to the former. But before I enter upon that subject, I would fain know of the Chevalier whether we shall attend them in the capacity of indolent persons, in order to receive instruction from them, or as virtuosi, to view them only with admiration.

Cher. I understand you, Sir. I remember very well, that in the *Proverbs of Solomon* *, the sluggard is directed to go to the ant, that he may learn to be provident and industrious. Tho' I am not, perhaps, one of those indolent wretches, yet where is the man that has no occasion to be taught a prudent forecast?

Prior. A sight of these laborious creatures is doubtless a lesson of instruction. They are a little people, united, like the bees, in a republick, which has, if I may be allow'd the expression, its peculiar laws and politicks. They have a kind of oblong † city, divided into several streets, which terminate at divers magazines. Some of them are employ'd in compacting the ground, and preventing its falling in, by incrusting it all over with a kind of glew. Such ‡ as we generally see, get several little splinters or small parcels of wood together, which they first draw over the tops of their streets, and make use of as beams to support the roof: Then they lay another row of splinters across the former, and cover them with a sufficient quantity of rushes, grass, and dry straw: These are raised with a double declivity, to divert the course of the water from their magazines; some whereof are set apart for the reception of their provisions, and others for the lodgment of their eggs, and such vermicelli as proceed from them.

As to their provisions, whatever is fit for eating is agreeable. You shall see one dragging along, with the utmost difficulty, the kernel of some fruit, and another almost sinking under the cumbrous load of a dead gnat. A whole swarm of them shall sometimes be employ'd at once about the carcase of a may-bug, or some such other insect. They eat without reserve or delay whatever they are incapable of removing; but what can possibly be preserved, is carried home with all the care and circumspection imaginable. The whole community have not the privilege to range here and there without restriction or controul. A detachment is order'd out to get intelligence; and, according to their report, the whole

* Prov. vi. 6.

† Aldrovand. de Formicis. Johnston. Thaumaturg. Nat. P.
356.

‡ Hist. of the Buscaneers, towards the conclusion,

whole society are immediately in motion, in order to attack some mellow pear, some sugar-cake, or a glass of sweet-meats. They readily quit the garden for the house, and mount even three stories high, in order to get at the glass before-mention'd. Tho' 'tis there that they discover this mine of sugar, this *Peruvian* treasure, yet their march to it, as well as their departure from it, is under some regulation. The whole band, however dispers'd, are order'd to rally, and move together in the same track: These injunctions, however, are not executed with the utmost rigour; for sometimes they are permitted to rove a little, upon a favourable prospect of springing some fresh game in the country. The green vermin, which make such havock amongst the flowers, and cockle the leaves both of the peach and the pear-tree, are a regalia for the ants. When they are seen in swarms on any plant whatever, they are in pursuit after this delicious entertainment; and those vermin before-mention'd, whether in the egg only, or released from it, are often the real authors of all that devastation to our trees, which is ignorantly ascribed to the ants, and draws down upon their heads not only a very cruel, but an unjust persecution.

Their next darling passion is, to treasure up a large quantity of such corn, or other grain, as will keep the longest; and for fear such corn should, through the dampness of their subterranean cells, shoot up, we are credibly informed that they gnaw off those buds which are at the point of the grain.

I have seen some ants that have carry'd, or rather push'd before them, several grains of barley or wheat, considerably larger than themselves. I have not, however, been so fortunate as yet to discover their granary. All the ancients make mention of it, and *Aldrovandus* assures us that he had seen it. 'Tis probable, that their labours, as well as their inclinations, may differ according to their species.

The ants, after they have spent the whole summer in one continued scene of hurry and fatigue, confine themselves within their cells all the winter, and reap the fruits of their labour in peace and tranquillity. 'Tis highly probable, however, that during their retreat

they eat but little, and are either benumbed with cold, or, like several other insects, dissolved in sleep. From whence 'tis reasonable to suppose, that their industry in harding up their provisions is not so much intended to guard themselves against future exigencies, as to secure, during the harvest, a necessary subsistence for their young. They rear them, as soon as they are hatch'd, with that tender regard that employs the whole community; and the maintenance and welfare of their little ones is look'd upon as a concern of the last importance to the publick.

When their young first burst their egg, they are vermicelli about the size of a grain of sand. After * they have received their nutriment for a time, which is brought to them in common, and divided into equal portions, they spin a thread, and enclose themselves in a white and lucid web; cease to eat, and become aurelias. There are some people who take them (during this state of inaction) for ants eggs; but, in fact, they are the nymph, from whose spoils some future ants are to arise. Notwithstanding the young will eat no more, their nurture is still a constant fatigue to their parents. These, for the generality, have several habitations, and remove their young from that wherein they were first rear'd, to some other apartment, in which they propose to establish a new set of inhabitants. These aurelias, or nymphs, are either raised towards the surface of the earth, or sunk to some distance from it, according as the season proves hot or cold, dry or rainy. When † the weather is calm and serene, they raise them; and sometimes expose them to the warm rays of the sun after a shower, or after a long drought to the gentle dews: But at the approach of night, rain, or cold weather, they hug the r tender charge in their indulgent arms, and descend with them so low in the ground, that one must dig at such times above a foot deep before those nymphs ‡, or aurelias, can be discover'd.

There are several other branches of their conduct that might be enlarg'd upon; such as their dispersion all over the country, their custom of removing their dead out of
their

* *Lenwenhoeck's Arcan. Nat. Tom. 1 and 3. Ep. 3.*

† *Hist. Gener. des Insects, par Swamm.*

‡ *Lowthorp's Abridgment, Tom. 2. p. 7 and 9.*

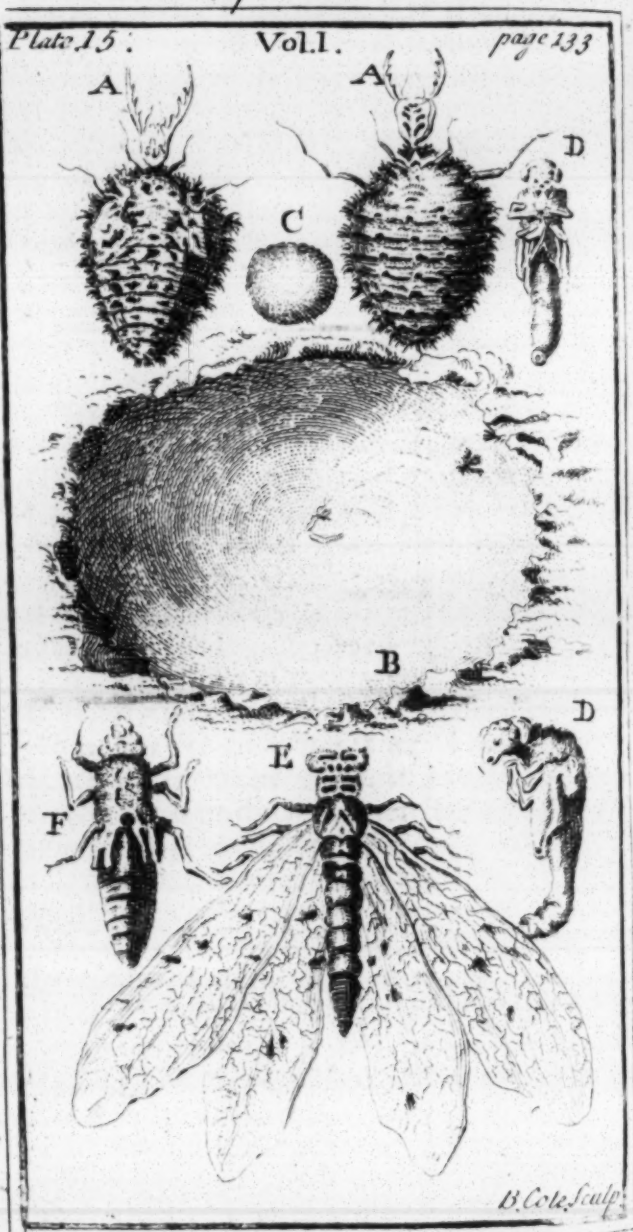
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Plate 15.

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their habitations, their readiness to assist each other in the carriage of their burdens, or the invasion of their enemies. We might expatiate likewise on the little sting which they carry in their tails, with a bag of corrosive water, which raises little swellings, or tumours in the flesh. A long detail might farther be given of those wings, which are conferred on the males at a certain age, for the acquisition of their food with the greater ease; but denied to the females, in order that they may be more sedentary, and more devoted to their domestick concerns. But the subject which the Chevalier has made choice of for our farther amusement is so exceedingly agreeable, that it would be an act of injustice to the company to trespass on their patience any longer.

Chev. After the history of the ant, nothing, in my opinion, can be introduced more naturally than a detail of the *Formicaleo*; so called, because 'tis the lion, or the most formidable enemy of the whole race of ants.

Countess. Why can't you call it the *Lion-pismire*? We are masters of the terms, at least, in our academy.

Chev. The term, Madam, which you have given it, is perfectly agreeable; and I'll assure your ladyship, that for the future, I'll never distinguish this little fierce animal by any other title. I was at the Prior's yesterday, where I was obliged with a sight of a very pretty picture, wherein were delineated all the various transformations through which that creature passes. Tho' I have a tolerable idea of the whole train of particulars *, yet, lest I should be troublesome in the repetition, or should forget any material incident, I have committed my thoughts upon the subject to writing, and I hope you'll indulge me with the liberty of reading it, especially since the Prior has been pleased to touch it up with his own hand; and that, I presume, you will allow to be a material article.

Countess. Your apology, Sir, is deliver'd with such an air of freedom, that it might pass for an introduction to the most entertaining history.

Chev. The lion-pismire is much about the length of a common palmer †, or wood-louse; but then 'tis somewhat

* Mr. Aubrit. Definat. au Jardin Royal.

† The Memoirs of the Acad. of Sciences. Mr. Poupert, 1074.

what thicker. It has a very long head, and its body grows round as it lengthens towards the tail. As to its colour, 'tis a dark grey, and mark'd with black spots. Its body consists of several flat ringlets, which glide over one another. It has six feet, four whereof are inserted in the breast, and two in the neck. Its head is small and flat; from the fore-part shoot out two little horns, which are smooth and hard, about two twelfths of an inch in length, and bent like hooks at the extremes. Towards the base of these horns it has two small eyes, which are black as jet, very sprightly, and serviceable to the last degree; for it starts at the smallest objects that present themselves before it.

Other animals are provided with wings, or at least with feet, to enable them to pursue their prey. This, however, is only capable of moving backwards. He never pursues his prey, and would sooner die than advance one step towards it: His prey must come to him, and he has learnt the art of making it fall into the snare he has prepared for it: 'Tis to this artifice alone he owes his subsistence; and altho' 'tis all the knowledge he is endow'd with, yet 'tis sufficient for his purpose.

He makes choice of a bed of dry sand, at the foot of some wall, or under some covert, that his work may receive no damage from the injuries of the weather. Not only sand, but the driest he can procure, is best for his purpose; because either a hard ground, or a moist sand, would prove an obstruction to his operations. When he proposes to hollow the trench, or ambuscade, for the ensnaring of his prey, he begins with bending the hinder-part of his body, which terminates in a point. After this he plunges it, like a plough-share, into the sand, which he removes by a retrograde motion: And thus, by frequent repetitions, and various little tours, he traces out at last a circular furrow, the diameter whereof exactly corresponds with the depth to which he determines to sink it. Having planted himself in the center of that circle, he plunges himself still deeper into the sand, which he throws up with his horns some little distance from the furrows, always observing a retrograde motion in a spiral line, in proportion to the depth he sinks. The reiterated blows with his head make the sand fly out of the circle, and

and by slow degrees evacuate the inner part. This is the artful method he observes in the completion of his trench, which bears a very near resemblance to a cone revers'd, or rather the internal part of a tunnel.

The furrow which the lion pismire traces, when he is first hatch'd, is but very small : However, as he increases gradually in bulk, he makes it more extensive ; the cavity whereof may probably be two inches or more in diameter, and much about the same in depth. When he has accomplish'd his work, he lies in ambuscade, and conceals himself in such a manner under the sand, that his horns exactly surround the point wherein the bottom of the tunnel terminates. Thus he watches for his game, and inevitable ruin attends the ant, the wood-louse, or any other insect, that indiscreetly rambles round the edge of this precipice, which is made shelving, and in the sand too, that such animals as approach it unawares may tumble in. 'Tis in hopes of ensnaring the female ant, that the lion-pismire thus lays the ground-work of his kitchen. She has no wings, as most other insects have, to disengage herself from this fatal den. Other animals, however, as well as she, are ruin'd and undone by the dexterity and address of this insidious hunter. As soon as he perceives, by the fall of a few grains of sand, that some game is near, he retreats a step or two, and by that motion saps the foundation of the sand, which immediately falls down to the bottom with the prey. If such prey be an active animal, if it springs up in an instant, and especially if it has wings, the lion-pismire flirts a quantity of sand all over her. Such a shower of stones must doubtless be shocking to so tender an animal as a gnat or an ant. Thus blinded, and overwhelm'd by the impetuous storm, that pours down on every side, and carried away by the unstable sand, which rolls from under her feet, the unfortunate insect falls between the two jaws of her enemy, who plunges them in an instant into her body, drags her with violence under the sand, and there regales upon his captive. When he has gratified his voracious appetite, and nothing more remains than the carcase, drain'd of all its juices, he takes particular care to remove and conceal it. The sight of a dead body might probably prevent some future visits, and render his habitation a place of ill repute : for which reason

son he extends the mangled carcase on his horns, and with a sudden jirk throws it about half a foot beyond the edges of the trench. If he finds the trench too much encumbered and filled up by this expedition; or if the aperture becoming too large for the depth, should lose its proper slope, he instantly repairs the whole; he rounds, hollows, and clears his den, and then lies upon the catch for some new victim.

The profession of a hunter, all sportsmen allow, requires abundance of patience; and the lion-pismire is endow'd with a large share of that quality, as of artifice and deceit. He will sometimes spend whole weeks, nay, months together, without motion, and, what is still more surprising, without the least subsistence.

His abstinence, which is of singular service to him, is so remarkable, that I have known him to live above six months in a box, shut up as close as possible, without any thing in it except a little sand. I have seen several of them accomplish their work as usual; and afterwards metamorphose into nymphs, like others, which I have supported with all imaginable care. It must be acknowledged, however, that such as eat, grow larger, and improve in strength and vigour.

When this lion pismire has attain'd a certain age, and is desirous of undergoing a state of renovation, in order to make his appearance in the last form he is to assume, he then concerns himself no more about his trench; but sets himself to work in the sand, and therein strikes out a thousand irregular tracks, which labour he strenuously pursues, in order, no doubt, to throw himself into a violent sweat; after which he plunges headlong into the sand. That glutinous moisture, which by such excessive motion flows from each part of his body, fastens to, and unites with all the grains which he touches. With these particles of sand, and the dry'd glew which so consolidates them, he forms a kind of coat or crust, which surrounds and covers every part of him, like a little ball of about five or six twelfths of an inch in diameter; wherein the insect takes care to reserve for himself sufficient room to move with ease and freedom. He is not contented, however, with bare walls, which would doubtless chill him after his sweating; but spins out of his own
bowels,

bowels, a thread, which, with respect to the fineness of it, infinitely surpasses that of the silk-worm, whose operations we have already descanted upon, and view'd with admiration. When he has thus manufactur'd a sufficient quantity, he fastens it first to one place, and then to a second, still crossing and recrossing his threads, and glewing them one over another; by virtue whereof he furnishes h's little retreat with pearl-colour'd sattin hangings, which strike the eye in the most agreeable manner, and are fine beyond expression. In this operation, all the beauty and convenience lies in the internal part: There is no external appearance of any thing but a little sand, which confounds the apartment of the lion-pismire with the earth which lies round about him. By this artificial covering he lies conceal'd in safety from the injuries and insults of ill-designing birds: There he dwells in obscurity, and lives in perfect peace and tranquillity; whereas he would be inevitably ruin'd and destroy'd, was the outside of his mansion embellish'd with any decorations that might attract the eyes of his enemies upon him.

In this manner does he live attract'd from the world, for six weeks or two months together, and sometimes more; and then resigns his eyes, his horns, his paws, and his skin, which sink to the bottom of the ball, like a bundle of rags: There is nothing of him now remaining but a nymph, or embryo, with other eyes and paws, with other wings and entrails, all pack'd up and enclosed in a new skin, and conceal'd in a nutritive fluid, in which the new animal gathers strength by slow degrees. As soon as the limbs of the new creatures have acquir'd their due tone, and their necessary vigour, he pulls down the tapestry hangings with which his mansion is adorn'd, and forces his way through the walls that obstruct his passage by making use of his two teeth, which bear a near resemblance to those of a grasshopper. Now he uses his utmost efforts, enlarges the aperture, squeezes half his body through, and, at last, totally abandons his solitary apartment. His long form, which turns and twists like a *volute*,* and takes up the space only of three twelfths of an inch, begins to open and expand itself, and, in a moment,

* A volute is that part of the capital of a pillar which twists and turns into a spiral line.

moment, measures between fifteen and sixteen * lines in length. His four wings, which were folded up, and took up no more space in the film that sheathed them, than two twelfths of an inch, begin to expand themselves, and in less than two minutes, become longer than his whole body. In short, the miscreant lion-pismire is transform'd into a large and beautiful dragon-fly, who, after she has stood for some time motionless, and like one astonished at the glorious display of nature, claps her wings, and enjoys a liberty unknown before. With the tatter'd remnants of her first form, she has divested herself not only of her cumbrous weight, but likewise of her barbarous and bloody inclinations: She is quite another creature: And, in short, all gay and sprightly, noble and majestic.

There are other † animals to be met with on the edges of ponds or standing-waters, who (though like this in form) are tinged with colours much more beautiful and lively, and of a quite different species. The insect that owes its being to the lion-pismire, deposits her eggs in the sand, in order that her young may be furnish'd with food as soon as it bursts its shell. For though sand is no part of its aliment; yet 'tis that by which it procures its daily subsistence. The insect at once sinks a little regular trench, and in the twinkling of an eye becomes an expert huntsman, and an able geometrician. The other dragon-fly that hovers over the surface of ponds, sinks the extremity of her body in the water, and there deposits her eggs. The animals which arise from them, live for a time in the water; then assume a new form, and inhabit the earth in the state of nymphs: I am not, however, perfectly acquainted with the manner of life, or the metamorphosis of this last mention'd creature.

Countess. I would advise you to pry farther into their history; for it must doubtless prove very entertaining, if 'tis but as agreeable as the lion-pismire. And I can assure you, Chevalier, you have my hearty thanks for making choice of so delightful a topick.

Chev. Your Ladyship's compliment of right belongs to the Prior. For, as I told you before, 'tis to his goodness entirely that I owe all my materials.

Countess.

* About an inch and three or four twelfths,

† Mr. Aubrit, Desinat, au Jardin Royal.

Countess. I own, Gentlemen, I ought to acquit myself in my turn : But as it grows late, I hope you'll give me credit till to-morrow ; at which time the conference, if you will indulge me so far, shall be held in my own apartment.

SHELL-FISH,

And other

TESTACEOUS ANIMALS.

DIALOGUE IX.

The Count and Countess, the Prior, and the Chevalier.

Countess. **P**RAY, Gentlemen, walk in.

Count. Bless me ! what a number of glasses are here ! How regularly they are rang'd too !
—— What rarities, Madam, have you provided for us ?

Countess. A little collation, my Lord, for your amusement.——To your glasses, Gentlemen.

Count. How slimy this water looks ! —— If I am not mistaken, I see some sea-mussels lie at the bottom, on a little bed of sand. Are we to have these, Madam, instead of fresh oysters ? The regale, I confess, is something novel.

Countess. Something more agreeable, my dear, than you are aware of. I am persuaded your Lordship will thank me for it.—Is there nothing, Doctor, that strikes your eye, besides the mussels ?

Prior.

Prior. Here's one, I perceive, quite open, and fastned with several fine threads to a thin cake or clod. One might take it for a pavilion in miniature, with all its appurtenances of pins and cordage.

Count. Here are two others likewise fastned to the glass, but with a less number of strings. 'Tis something curious, indeed, my dear. And I plainly perceive your Ladyship intends to amuse us with a set of spinsters.

Countess. True, my Lord: And I freely acknowledge, that I took the hint from your entertainment of the Chevalier the other day, with the various operations of caterpillars and spiders.—Yours, you know, were only land-spinsters; but mine are of another species, peculiar to the sea. 'Twas by a meer accident that I got a sight of them, and I determin'd to secure them for the Chevalier's further amusement.

Cher. Your Ladyship, for once, is out of your province: These are neither the product of your court-yard, or your garden.

Countess. True, Sir: But then they properly belong to my kitchen. Some few days ago my steward paid the *Ripier*, who carries sea-fish once a week all round the country, for some oysters, and other fish that he had bought of him. My curiosity induced me to examine, for a few minutes, a parcel of mussels before they were deliver'd to my cook: which I did, and was surpriz'd to see such a number of little packets, or balls of thread: Whereupon the honest fellow, in his sea-faring dialect, assur'd me, that the mussels could not possibly subsist without them; that they made use of those strings, or threads, as cables to belage, or keep themselves firm in their moorings. I was pleas'd, I confess, with this information of his, and imagin'd there was something in it that might amuse you likewise; whereupon I order'd him, the first time he came our way, to bring me two stone jars, full of sea-water, with a little mud, or slime, and some live mussels upon it. He brought me some accordingly, much sooner than I expected. I pour'd off the water into one glass; put the slime, or sand, into another, and the spinsters into a third, in order to observe the consequence: And three or four of them are, I find, at work already. They spin, beyond
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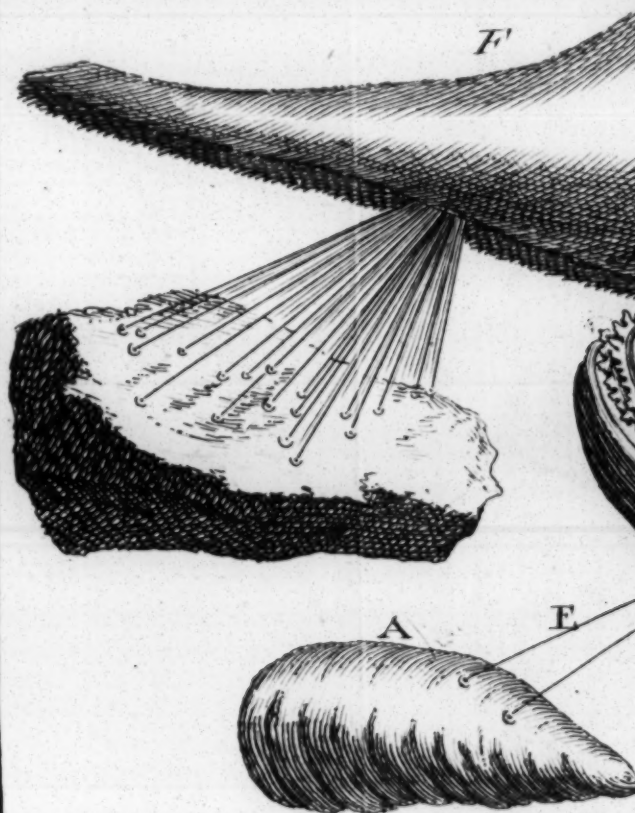
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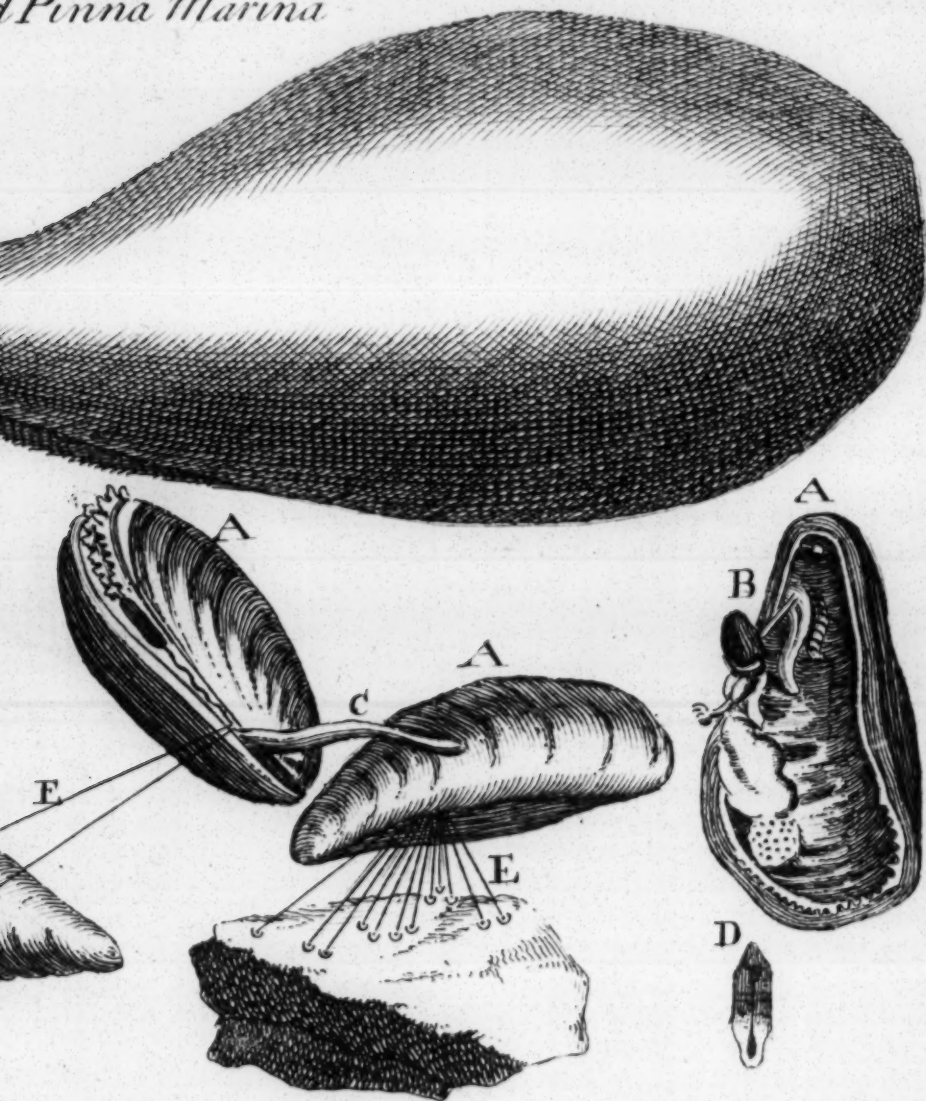
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all dispute, those little threads which you now see; since not one of them was visible till yesterday. They fasten themselves with these threads to the mud, or gravel, by natural habit, in order that the water may not wash them away; but after what manner this thread is spun, I own, I am at a loss to determine.

Prior. This, Madam, is one of the most agreeable collations I ever met with.

Count. Your Ladyship could not possibly have provided a better entertainment for us.

Countess. I am proud, Gentlemen, of your compliments on this occasion: But to see your noses laid thus close together, and your eyes thus wishfully fix'd on these three glasses in particular, gives me a pleasure beyond expression. — O that I had but a painter here to draw your pictures!

Count. Doctor, can you discern any thing extraordinary in the work before us?

Prior. Yes, my Lord; I can discover in these three glasses, that * the mussel darts out of her shells a trunk, or tongue, wherewith she seems solicitous to find out some proper place to fix her thread.

Count. I have been credibly inform'd that all shell fish, of the mussel kind, have a sort of trunk; and, indeed, I have often made the same observation myself, even in such as have been boil'd. I am sensible, that they make use of this trunk, as a foot, when dispos'd for motion; that they can extend it out of their shells, at least an inch and an half; and can glew it to the gravel; but how, or in what manner, I cannot determine. When they have so done, they can contract it at pleasure, and by that means trail along their little habitations, and transfer themselves, as occasion offers, from one place to another. But this trunk is of singular service to them in another respect, of which her Ladyship seems to have a very just idea. The animal must not only find out such juices as are proper for its nutriment, but must be enabled to fasten itself, in order to reap the benefits of its labour: Defenceless, however, as it is, the least breath of wind, or agitation of the waves, which are seldom, if ever perfectly still and motionless, along the

* Memoirs of the Academy of Sciences, Mr. de Reaumur, 1711.

the coast where she finds her food, would transport her in an instant to a great distance; for which reason, these threads, or cables, in what manner soever made, were conferr'd on her by nature, as anchorage, to keep her firm and steady.—Now, Gentlemen, let us endeavour to find out, if possible, the mechanism of her work.——

Methinks I have some idea of it already. Have but patience for a few minutes, and I don't question but I shall be able, by the help of this microscope, to give you a satisfactory account of it.

I can distinctly discern, that there is a narrow gutter, or canal, which runs thro' the trunk from one end to the other. The mussel has now brought the sides of it together. There is a drop of liquor this moment ejected out of that end, which touches the slime or gravel, to which she is fix'd.

Prior. 'Tis true, my Lord, the drop is become orbicular, and begins to thicken.

Count. 'Tis my opinion, that the whole trunk folds up like a thin sheet of lead, in a globular manner thro' its whole length; and that the insides being drawn pretty close together, there is a little gutter, or canal left, in which the glutinous matter which forms the threads, is coagulated, and made like a wax-candle in a mould.

Prior. Your Lordship's observation is very just; for now the whole trunk is visibly unfolded from one end to the other, and laid perfectly flat. The fluid which is condensed in the canal, is discharged from the mould, by such expansion of the tongue as aforesaid; and now you may clearly discern a new string made, one end whereof proceeds from the stomach, and the other terminates in the thin cake, or clod to which it is fastned.

Count. 'Tis evident, however, that the animal is not as yet so well fix'd as it ought to be. For I perceive the trunk extended again, in order to find out some proper place for the fastening of a new string. Let us trace her thro' all her motions.

Chev. An excellent trunk this, truly! In the first place, the mussel makes use of it as a leg, when disposed for motion; then, as a tongue, to relish the several juices, as she tastes them; and lastly, as a mould to form the cords, or strings, with which she makes herself firm and steady.

(*Count.*

Count. I don't question in the least, but that her strings are made in the manner above-mentioned; and now I clearly comprehend how the large sea-mussel can, with a much finer implement, spin such threads as are more valuable than silk itself, and with which the most beautiful stuffs, that were ever seen, were made by the *Sicilian* weavers.

Cher. But, my Lord, there is a difficulty that arises here, which cannot, in my humble opinion, be easily solv'd. When the mussel has eaten, or suck'd up all the juices which she finds proper for her aliment in one place, what methods, pray, does she take to disengage herself? These strings surely must then be a very great incumbrance to her.]

Count. What you motion, Sir, seems to carry a great deal of weight with it. As I have not as yet seen the whole operation, I cannot offer any thing positive, in order to clear up the objection you have rais'd. 'Tis indisputable, however, that the mussels have a progressive motion, and that they transport themselves from one place to another. From whence I infer, that as they are furnish'd with a sufficient stock of glutinous matter, wherewith they make their strings, and fasten one end of them to a stone; so nature has either kindly bestow'd on them a dissolvent liquor, which they diffuse, as occasion requires, on the ends of their strings; or else has appointed some other ways and means to disengage and set them at liberty, when dispos'd to pitch their-tents in some more commodious situation. I could wish we liv'd somewhat nearer than we do to the sea-shore: 'Tis another world, which we have but an imperfect idea of. By the success of her Ladyship's experiment, 'tis evident, abundance of curious discoveries might be made there.

Countess. Had we liv'd on those coasts, where the large sea-mussels are frequently found, instead of manufactures of coarse thread, I would have produc'd you a set of fine spinsters. I must confess I [should have been extremely delighted with seeing their operation, and reaping the advantages of their little labours.

Count. I have seen gloves at *Palermo*, made of this superfine silk; and it is not impossible, I believe, to procure your Ladyship a sample.

Prior.

Prior. I * have seen gloves of a quite different sort of silk.

Countess. Pray what sort may that be?

Prior. The silk, or fine thread of a spider. The Gentlemen of the *Academy at Montpelier* sent them as a curiosity to the *Academy of Sciences*. Some short time afterwards, they wove several pair of stockings and mittens of the same materials, and presented them to the Dutchess of *Burgundy*.

Countess. As this sort of silk is so common, I wonder it never was erected, by some of our viriuosi, into a manufacture.

Count. This was an essay of the ingenious Mr. de *Reaumur*, who attempted to collect a large number of these insects for that purpose: He order'd them to be constantly supplied with flies; and the ends of young feathers, fresh pick'd from chickens and pigeons, because they are full of blood, may be procur'd without any difficulty, and are besides a kind of diet that spiders are peculiarly fond of. But notwithstanding all his care to provide for them in this elegant manner, he was soon convinced that it was impracticable to rear them, since they are of such a malignant nature, that when any number of them live together, they will sacrifice all other views, how advantageous soever, for the single satisfaction of devouring one another. From whence 'tis plain, these insects are incapable of being establish'd into a community, or social republick. And indeed, were it practicable to reconcile them, it would take up too large a spot of ground, and require too much attendance to rear up a number sufficient to render the project any way successful. Moreover, their thread is four, if not five times finer than that of the silk-worm. So that, upon the justest calculation that can be made, there must be sixty thousand spiders employ'd to produce a pound of their silk. Besides, 'tis a great question, whether the thread which they commonly spin could be manufactur'd at all: For what has been hitherto made use of, is that only, in which they deposit their eggs, which is four times stronger than the thread of their web. In short, from the whole, we may justly conclude

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conclude, that your Ladyship will never be over-stock'd with gloves of this manufacture.

Countess. I find then I must provide myself elsewhere.

Cher. I can easily conceive how the mussel, by the help of her trunk, can march forwards, or rest at pleasure; but I found the other day a snail, upon a vine-leaf that hung at my window, and saw him advance, by slow degrees, without either trunk or legs to assist him in his progress. How this operation is perform'd, I own, I am at a loss to determine.

Countess. Neither can I rightly conceive how the snail, the mussel, and, in short, how any testaceous animal whatever, erects its little mansion, which it carries on its back; nor in what manner it retreats upon the gentlest touch.

Prior. I have, for my own part, examined the structure of a snail with more than common attention, and can oblige your Ladyship with the whole history of him, except only the formation of his shell: As to that part, indeed, I shall refer you to his Lordship.

In the structure of this insect there are no plumes required, no hair, nor cones of silk. 'Tis a new order of being: The intentions of it are quite different. Every animal that nature has produced, has its proper mansion, and every lodgment its peculiar beauties. There are two conveniencies which the snail enjoys under his little roof, tho' seemingly inconsistent; that is to say, an uncommon solidity, and yet a surprising lightness; by virtue whereof he is secured from all injuries and insults; carries his apartment with him wherever he thinks proper, without the least fatigue or incumbrance, and is always at home, let him travel where he pleases. When winter comes on, he * withdraws into the warmest nook or corner he can find. There he diffuses from his body a certain glew, which condenses at the opening of his shell, and forms a perfect enclosure. In this warm retreat he spends the uncomfortable season, as many other insects do, without any uneasiness, or want of subsistence. When the spring introduces more gay and chearful days, the snail breaks thro' his confinement, and marches abroad to seek

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* Memoirs of the Academy of Sciences, 1709.

his fortune. His necessities now revive with his appetite; But slowly creeping along, as he is oblig'd to do, with his house upon his back, were his eyes as low as his body, which trails all along the ground, he would never be able to discern those objects, which he ought to avoid, or to pursue. At best, he would be ever liable to the inconvenience of soiling his eyes in mire and dirt. For which reason, nature has furnish'd him with four telescopes, which give him timely notice of all such objects as approach him.

Chew. Pray, Doctor, did you ever see the tubes of these telescopes?

Prior. I'll assure you, Sir, I am serious, and inform you of nothing more than a simple fact. You must not imagine, that those projections, which are by children, for the generality, term'd the snail's horns, are such in reality. They are four * tubes, with a glass at the end of each of them, or four optic nerves, terminating in four beautiful eyes. He does not only raise his head, in order to take a distant survey of things, but elevates his optic nerves and eyes at the end of them, still much higher. He lengthens and directs them wherever he sees convenient; so that they are, properly speaking, telescopes, which he turns and contracts, as occasion offers.

Thus lodg'd and illuminated, he is capable of discovering whatever may be convenient for him: But as nature has not furnish'd him with any feet, what methods must he take to procure what he has occasion for? This deficiency is amply supply'd by two large † muscular skins, which, by expansion, are considerably lengthen'd; after that, the fore-part being folded up, the hind-part is contracted in the same manner; and thus the house, which rests upon his surface, is trail'd along. ———Here, indeed, a new difficulty occurs. As this insect is ever glew'd to the ground, and has no wings to raise it into the air, nor thread to keep it steady, it must perpetually be expos'd to the danger either of falling from some eminence, or being drown'd in the first water in which it plunges. In short, the moisture itself alone, would pene-
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* *Lifter, Exercit. Anatom. Cochl.*

† *Derham, Theol. Phys. l. 9. c. 9. 1. Lifter ibid.*

trate and destroy it. Nature, however, has been so indulgent as to free it from all these dangers and inconveniences, by a plentiful supply of a thick, viscous humour, which, by its tenacious quality, prevents it from falling, and renders it impenetrable to all humidity whatsoever, by virtue of an oil, with which all the pores of its skin are sufficiently clos'd. He is very frugal and careful of this his precious fluid, and avoids the sun, as much as possible, which would cause it to evaporate, and preserves it with all the ease imaginable in moist grounds, wherein it proves of singular service.

Nothing now obstructs him from marching abroad in pursuit of some proper subsistence. As soon as he has found it, he sets to work upon it, hacks, and tears it in pieces, with two * sharp teeth, with which he frequently proves very destructive to the best fruits, and the tender buds of plants, nay, to the leaves themselves; on the preservation whereof, that of the fruit likewise, in a great measure, depends. As contemptible an animal, therefore, as this reptile may seem to be to us, 'tis evident, that nature has been indulgent to it, and bestow'd upon it more advantages than most, at first view, are apprehensive of.

But what is more surprising than all the rest, is, that the whole species are hermaphrodites, † and partake of the nature of both sexes; insomuch that, as soon as the one has impregnated the other, the same act of generation is immediately return'd. When they are mutually inclin'd to such a copulation, they communicate their inclinations in a manner peculiar to themselves. One of them shoots a little arrow, or dart, at the other, which has four little wings, or sharp edges, and either sticks fast to the other, or falls down by his side, after a slight penetration. Whereupon another arrow is immediately dispatch'd, in return, at the aggressor: This petty fray is soon adjusted, and a strict friendship immediately ensues. This dart, or arrow, in substance, resembles a piece of horn, with which these reptiles are plentifully provided, at such seasons as these amorous engagements

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* Godart. Insect. Tom. 1.

† Hist. of the Acad. of Sciences, 1702. p. 48.

are commenced; that is to say, thrice in six weeks, or once every fifteen days. Each of them, eighteen days after these approaches, deposits its eggs in the earth, and conceals them there with all the care and precaution imaginable. What I should be glad to know at present is, whether the shell of the snail is form'd in the egg or not; and how, and in what manner it gradually increases, and is duly repaired, as often as necessity requires.

Count. As to those difficulties, Doctor, I flatter myself, that I am able to give you a satisfactory solution: I have made five or six experiments on that very account, which have succeeded according to my wish, and consequently put it in my power to give a pertinent answer to all your queries.

When * the snail bursts its egg, it comes into being with its shell upon its back, completely form'd, but very small in proportion to its body, and the egg from whence it proceeded. This shell is the basis or foundation of a second, which is always augmenting, tho' by imperceptible degrees. The little shell, such as it comes from the egg, will at all times be the center of that which the animal forms, when advanc'd in growth, by an addition of new circles to the first; and as its body can be extended no where, but towards the aperture, that opening only can, by consequence, receive such augmentations. The matter, or substance, whereof it is compos'd, subsists in the body of the creature, and is no more than a certain slimy fluid, consisting of glew, and divers particles of the finest sand. This fluid passes through an infinite number of little channels, till it proceeds to the very pores wherewith the whole surface of the body is perforated. As these pores are all clos'd by the shell that covers them, the compound fluid is repell'd to those parts of the body, which issue forth from the shell, and have nothing to cover them. These particles of sand and glew, perspire through the pores, and condense, by either sticking to, or drying on the edge of the shell. Of these materials a simple film is soon compos'd; under which a second is extended, and under that a third, from the union of these three films, or skins, an incrustation arises, which corresponds

* Malpighi Anatom. plant. de cochl. Memoirs of the Acad. of Sciences, 1709. Mr. de Reaumur. Leeuwenhoeck's Arcan. Nat. Tom. 3. Ep. 2.

in all respects, with the rest of the shell. As the animal encreases in growth, and the extremity of her body is not sufficiently cover'd, it continues its perspiration, and thereby erects its lodgment or little mansion. This is, beyond all dispute, the method it observes, not only in the construction, but the amendment likewise of its habitation. Some time ago, I collected a parcel of snails, and broke off part of their shells, without torturing the animals themselves. Having so done, I plac'd them under glasses, with a sufficient quantity of earth, and green leaves: 'Twas not long before I discovered, that that part of their bodies which was expos'd and visible, by such fracture as above-mentioned, was invest'd with a kind of froth, or sweat, which flow'd through all the pores. After this, I could plainly discern this froth arise by slow degrees, by another discharge of sweat, that flow'd under it; and at last, I found the surface of the former on a level with the old shell.

Prior. But is your Lordship certain, that this forming juice flows from the body of the animal, and not from the extremities of the adjacent shell?

Count. I have as full conviction as the nature of the fact will admit of. The method I took for my information was this. When I had made such fractures in their shells, as I before mentioned, I took the thin film that lies under the shell of a hen's egg, and plac'd it, as artfully as I could, between the body of the snail and the two extremities of the fracture. Had the shell contributed at that time towards its own reparation, the juice which had flow'd from thence had diffus'd itself all over the thin film, and had cover'd it, in proportion as the fracture had clos'd. If the juice, on the contrary, had flow'd from the snail's body, the little film before-mentioned had prevented it from running out, and the juice, in that case, had condens'd between the thin film and the body of the creature; and, in reality, that was the very case.

Prior. No objection, my Lord, can be made, in my opinion, to your experiment.

Count. My curiosity prompt'd me still farther to make a second. I broke off the last of the four or five circles, whereof the snail's shell is compos'd. After this, I inserted, between the shell and the body of the creature, a

small piece of the finest, and softest leather I could get, which I afterwards folded over the edge of the shell, and then fastened it with glew. Had the forming liquid diffus'd from thence, it must of necessity have burst thro', and carried away the thin film along with it; but I found no part of it in the least disorder'd. One third part, however, if not more of the snail, which was exposed to the air and uncover'd, are thrown immediately into a violent sweat, wherewith it form'd a new circle, which was so united to the old one, that the thin slip of the glove lay constantly between them.

Prior. I am glad your Lordship has clear'd up this difficulty; because the same facts which illustrate the formation of the snail-shell, will serve likewise for the explication of any other belonging to any kind of river, and sea shell-fish whatsoever. With your Lordship's permission, I'll start a new difficulty; and I am verily perswaded, that some new discovery will result from the proposition. Supposing then that the shells are actually form'd in such manner as your Lordship has describ'd, and the fractures made are repair'd by a glutinous fluid, which runs thro' the very same minute holes, thro' which it had ejected the matter, or substance, which had filled up the fracture; the new piece, that supplies the place of the old one, ought to be of the very same colour with that part which was broken, and, indeed, with all the rest of the shell: Now, notwithstanding all this, I have observ'd several snails, that have met with the like unkind treatment, repair their habitations, or coverings, in such a manner, as that the additional pieces were visible, being of a quite different colour from any other part of their respective shells.

Count. The objection you have rais'd does not any ways overthrow the truth I have advanced: And you have now given me a fair opportunity to illustrate the origin of those beautiful streaks, those marblings which we observe with so much admiration, on the shells of snails, and, indeed, of all shell-fish or other testaceous animals whatsoever.

Chev. The explication of their original would prove a very agreeable amusement to me; for I have seen abundance of shells, where the marblings, or streaks, have
been

been drawn from the little point in the middle to the very edge of the aperture, with all the regularity imaginable : And others again, where they have been interrupted, or where little spots have been interspers'd, which have borne no small resemblance or affinity to our musical notes. I should be extremely pleas'd to know from whence this diversity proceeds.

Count. I'll gratify your curiosity then. This diversity arises from the different disposition of the extremities of the animal's body, which are visible at the aperture of the shell. Several streaks are frequently discern'd in those parts, of a quite different colour from all the rest. This variety is an incontestable proof, that their texture is different from those that are adjoining ; and thus those juices or froths that flow into them, passing through divers strainers, whose little holes are different from those of the contiguous parts, acquire in that place a particular hue, or complexion. And as that part, where such streak appears, sweats, and performs its office, as the others do, and contributes with them towards the formation and gradual enlargement of the shell ; all the points of the shell that corresponds with that part, will be of one and the same colour ; but of a different tint, or dye, from the parts adjoining ; from whence it is plain, that those colours must be drawn out into streaks and marblings, and be so continued as long as the animal is regular in its motion, and makes gradual improvements in his shell, by frequent protrusions of his body.

But to give you a more adequate idea of this operation, I must inform you, that when the animal begins to encrease in growth, he draws his tail from the bottom of his shell, which is not then wide enough to receive it. He ascends, therefore, a step higher, and fastens his tail near the second, or third wreath, or circle of his shell, and enlarges his habitation at the aperture. When he makes these gradual ascensions, those parts of his body which occasion a variation of colours in the shells, by the diversity of their pores, form one continued streak without the least intermission. But when the animal, in changing its situation, leaves a space between the point from whence he removes his tail, and the new one to which he fixes it, all the other parts of

his body move in equal proportion. At that time, those parts of his body which created those stains being transferred to some distance from the preceding ones, tinge the shell in such a manner, as that there is some space, either more or less, between one spot and another. And this, my dear Chevalier, is the origin of your musical notes. There are various causes, likewise, which may concur in the streaking and marbling the out side, with either faint or lively colours. The quality of the creature's food, its good or ill state of health, the inequality of its constitution, according to its age, and the alteration that may proceed from the different pores of its skin; a thousand accidents, in short, may intervene, either to make the colours glow, or look languid, and diversify the whole *ad infinitum*.

If the shell imitates, with respect to its various colours, the diversity of the animal's pores, it must, indisputably, assume the form of that body whereon 'tis moulded. Thus 'tis observable, in all sea shells, that in case the animal has any tumour or excrescence on its body, it creates likewise a swelling in that part of the incrustation which is correspondent to it. When the animal begins to alter its position, and to make new additions to its apartments, the same protuberance which had raised the shell before in one part, swells it again at some little distance; by means whereof we see the same inequality in a spiral line all round the shell. Sometimes these tumours of the animal are so large, or so pointed, that those which arise over them in the incrustation, appear like horns. After this, the animal disengages itself from its first cavities, and then by fresh evacuations, bestows on itself a new set of horns, with which it defends itself from the insults of those fishes, that look upon him as a delicious morsel. Moreover, if its body should happen to be channelled, the shell that covers it will be channelled likewise; if there be any protuberances in the body which wind in a spiral line about it the shell will likewise have its cavities and tumours twining round its tail, like a screw, to the extremity of its body.

Prior. What his Lordship has advanced with respect to the formation of shells, is confirm'd by objects which

are daily obvious to our view. Nothing can be more common than to find in the opening of a snail's shell, and all along the edges of the two shells of a mussel, a little skin or film; which is no more than the rough draught, or out-line of that augmentation, which the animal proposes to make to his apartment. Besides, when the shells of mussels, snails, or oysters, are thrown into the fire, the heat of it splits them into thin plates, or rather separates the different lays of matter, whereof the shell is composed, and makes them apparent, by drying up the viscous, or saline particles, which occasioned their cohesion.

Chev. Since we are upon the topick of shells or oysters, I should be glad if your Lordship would inform me, from whence those two little pearls, which we found in our oysters last night, could possibly proceed?

Count. My thoughts, as to that particular, Chevalier, are, that the oyster wherein they were found, was troubled with the gravel.*

Chev. Your Lordship is not serious sure!

Count. Yes, but I am, Sir.

Chev. How, my Lord! are those pearls we so much admire, and pay such an extravagant price for, the effect of a distemper in the animal that produces them?

Count. If the fact be not absolutely certain, 'tis at least, Sir, highly probable. That juice, or glutinous matter, wherewith oysters and large sea mussels form, by evacuation, the first plan and future enlargement of their shells, is sometimes extravasated, and forced out of its proper place. It is then collected in drops, and condens'd into little balls, or globular forms, of the colour of the shell, and these are the very pearls, Sir, which are so scarce as you observe, and so very costly.

Prior. 'Tis certain, that there is a very near affinity, with respect to complexion, between the pearl and the shell; from whence we may reasonably conjecture, that the materials of both are much the same. Some years ago, when I was at *Toulon*, a friend, I remember, shewed me some large sea-mussels, the shells whereof were above two feet long. When we came to open them, we found

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several

* *Memoirs of the Academy of Sciences, 1717. Mr. de Reaumur. Actes de Leips. 1686. Bonanni.*

several pearls; some red ones, and others of the colour of *Naker*; the former, however, were lodged in that part of the animal, where the streaks, or marblings of its body had ting'd its shell with red, and the latter were in that part where the shells were dy'd with the colour of mother of pearl. This plainly shews the exact conformity which there is between the juice which forms the shell, and that which constitutes the pearl.

Let us, however, recollect whatever can be advanced against this system. Crabs annually cast off their shells, and eject, in the room thereof, a fluid, which invests their whole bodies, and which, growing dry and hard, in process of time becomes as strong a shell as that which they had before. At the approach of this their moulting time, (if I may be allowed the expression) there are certain stones found in their bodies, which are generally (but without any just grounds for it) called their eyes. These stones diminish, in proportion as the new shell consolidates, and when 'tis compleated, there are no more stones to be found in their bodies; from whence a very celebrated member of the academy drew the following conclusion, that these stones were the reservoir or repository of that matter, which the crabs make use of in the renewal of their shells. May not the case of the crab with respect to its eyes, and the oyster, as to its pearls, be much the same? And may not these pearls be a stock of materials made use of in the reparation of its shell, as necessity requires?

Count. The comparison which you have brought between the crab and the oyster, seems, at first view, I must confess, somewhat perplexing; but, upon second thoughts, is a confirmation of what I have advanced. Whatever constitutes the essential part of an animal, is to be met with in each individual of that species: And it cannot fairly be supposed, that nature should deny the generality of them the very thing on which their subsistence principally depends. On the contrary, that which is an imperfection in an animal, is found in some few only of the species; for no defect can be universal. The stones in crabs, which seem necessary materials for the renovation of their shells, are to be met with in the whole species of those animals at their moulting-time. There are

an infinite number of oysters, however, in which no pearls were ever found, from whence we may conclude, that those pearls in oysters are a natural imperfection and a defect which but seldom happens. For were those pearls the proper materials wherewith the oysters renewed or repaired their shells; then every oyster would be furnished with a sufficient quantity of them for that purpose.

Besides, travellers have observed, that those coasts, where the pearl fishery has been carried on with the most success, are the most sickly and unwholesome; from whence we may reasonably conjecture, that the oysters caught in those parts owe their pearls to some malignant distemper that attends them. The *Spaniards* have determined to be no longer concerned in this fishery in *America*; and we are credibly informed, that the air and water in the island of *Babren*, † from the banks and rocks whereof the divers there bring up large quantities of oysters, are insupportable to such merchants as traffick there for pearls. Nay, the peasants themselves can never be persuaded to touch one of those oysters, wherein they are found; so conscious are they of their malignant quality. On the other hand, the more delicious our oysters are, the fewer pearls are found amongst them; from whence we may naturally infer, that such waters as produce the largest quantities of these fish, with pearls in them, are very unhealthful; and that, on the contrary, such oysters as either live in more wholesome waters, or are nourished with kindlier juices, very seldom, if ever, produce those pearls, because they are attended with no indisposition, and their constitution is entirely free from all disorders.

Prior. I acquiesce, my Lord; your account has given me the utmost satisfaction.

Count. Tho' the Chevalier is no stranger to testaceous animals, yet if he'll step with me into my closet, I have a large escutore full of shells to shew him, the richness and variety of whose colours I am persuaded will exceedingly entertain him. In those few drawers he will find a collection of curiosities, which have been brought me from the four quarters of the world. Some gentlemen,

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who

† Gemelli.

who have a taste this way, will range their shells into different classes, and distinguish them by the names of such things as they resemble most. Tho' there is no extraordinary merit, I confess, in this distribution, yet it is not altogether useless; it prevents confusion, and throws this part of natural history into an agreeable method. Other virtuosi, who regard not so much the history of their shells, as the different effects which they are capable of producing by the assemblage and arrangement of their various colours, make curious collections of them, and work them up into artificial knick-knacks; such as flowers, garlands, grotto's, &c. But what I principally aim at, my dear Chevalier, in setting my collection of shells before you, is, to give you a more adequate idea of what we have been talking of, with regard to the manner of their formation.

Chev. I think myself infinitely oblig'd to your Lordship.—But I forgot to shew you three or four, which, in my opinion, are very curious, and very pretty in their kind.—Pray, my Lord, examine them.

Count. These are all petrify'd.

Chev. What do you mean by that, my Lord?

Count. That not only the shell, but the oyster within it, by lying in some particular water of a petrifying quality, has assumed the nature of a stone, without changing its original form.

Chev. I can't comprehend what oysters your Lordship means. Oysters, I take it, are the product of the sea; but these were found on the top of a high mountain. Some short time before my father went to *Amiens*, he covered his parterres and walks with sand. There are two hills contiguous to his estate, from whence his servants collected two several kinds of sand, and each of them of a very agreeable colour; one was grey, the other of a deep yellow. Whenever I went to inspect the workmen, they gave me a parcel of these little shells, which lay in heaps, and must doubtless be of a different species from those which are found in the sea.

Prior. Farewel, Gentlemen; I find you are deviating from the subject in hand, and going to examine the history of the earth before the flood.

Count.

Count. Let me beg the favour, Doctor, of your company a few minutes longer. Permit me to give the Chevalier one short lesson more by the way of digression.

—Come along with me, Sir, and I'll shew you three shells, the very same as yours: Both the one and the other, I'll assure you, have floated in the sea.

Chev. Who should give themselves the trouble, my Lord, to carry mine into the heart of a mountain?

Count. The sea, Sir, itself.

Chev. But the sea, my Lord, as I have been told, is circumscribed, and never flows beyond its bounds. It never extends itself, tho' the weather be never so tempestuous, to the distance of twenty leagues; and our estate, Sir, lies considerably farther from the sea.

Count. How, Sir! Can't you guess, when this accident happened? Know, Sir, that in the middle of *Africa*,* there are plains full of shells, three hundred leagues from the sea, and that large heaps of them lie on the *Alps* themselves. How, Chevalier, will you solve this inundation?

Chev. They must doubtless be carried thither at the general deluge.—Give me my shells again, my Lord; for I find they are rarities of more antient date than I imagined.

Count. All nations, Sir, have retained a remembrance of the deluge. The poets in their fictions have hinted at it. The whole earth is covered with indelible monuments, which attest the truth of it. The universal deluge, in short, is an occurrence, the proofs whereof are still obvious to our observation, however it happened, or how incomprehensible soever it may appear to be. From whence results this important truth, which, my dear Chevalier, I hope you will for ever keep in your remembrance; and that is this: That there are in nature, and the Sacred Scriptures, several things, which tho' above the reach of human understanding, are beyond contradiction true and certain, and capable of being proved even to a demonstration.

* Hist. and Memoirs of the Acad. of Sciences.



B I R D S.

DIALOGUE X.

The Count and Countess, the Prior, and
the Chevalier.

Countess: **G**entlemen, you seem to be at a loss for some new subject. We have long enough dwelt on the dull reptiles of the earth; let us proceed to the more sprightly tenants of the air.

Prior. Agreed. The whole universe, we see, is full of life. Each individual part of nature is replenished with action, and has its animals peculiar to itself. We can scarce move a step, without discerning some footsteps of a wisdom, which is as exhaustible in its various plans, as it is rich and fertile in the execution of them.—Observe that bird yonder! Though nothing is more natural to the eye of one who has been accusom'd to such a sight, yet nothing is more amazing to the eye of reason. A bird, when on the wing, is a mass raised high above the earth, notwithstanding the gravity of the air, and the natural tendency of all bodies to the center. This mass is conveyed to distant parts; not by any foreign force, but by a movement, peculiarly adapted to the nature of the bird, and which supports

supports her in the air for a long time with grace and vigour. This is a new subject of our admiration. When I take these birds into my consideration, I find that nature has bestowed but two wings on any species of them whatsoever; tho' each individual has something peculiar in the manner of its flight. Some advance by reiterated springs and bounds; others glide along, and cut the air in a smooth, easy, progressive motion: These skim only over the surface of the earth, whilst those mount, fearless, and almost reach the clouds: Some again are expert in the variation of their flight, know how to soar in a direct, oblique, or spiral line; to hover without any visible motion of their wings, in an element much lighter than themselves; after this, to launch out in a moment to the right or to the left, then to dart back again, to re-ascend, and at last to drop perpendicularly down like a falling stone: In short, they transport themselves without the least danger, or molestation, to what place soever their necessity or their pleasure prompts them. When I reflect on them in their little apartments, I find them still the just objects of my admiration. I am charmed with the structure of their nests, the tender regard which they shew for their eggs, the mechanism of those eggs, and the birth and culture of their young.

Countess. The Prior, in his enthusiastic way, has ranged in the most agreeable manner, the various particulars of our present entertainment. As to the nest, and the employment of the bird within doors, I'll take the description of them both upon myself; for I would willingly, methinks, have some share in the conversation, as well as the rest. Let me tell you, Gentlemen, I have made my thistle-finches, my pigeons and my mallards, my favourite study, and know every particular relating to them by heart.

Count. They are the best books, my dear, you can possibly read. The portraitures drawn from nature, always bear the most beautiful resemblance.

Chew. Your Ladyship must needs have made some curious observations in yonder aviary. If I am not mistaken, I have seen there not only a beautiful collection

lection of all sorts of little birds, but some too of a middling size.

Countess. The aviary, Sir, was partly my contrivance, and the little tenants of it are for the most part under my direction. My care of them, however, is amply recompenced by pleasures which daily vary. The petty quarrels in which they are sometimes engaged, their mutual endearments, their warbling notes, their little labours, and their grateful acknowledgments of my indulgence towards them, are, in my opinion, no trivial amusements. Sometimes I sit and work with them for whole hours and afternoons, and am never alone. The conversation there is never at a stand. If I am not mistaken, Chevalier, that is your favourite part of the house.

Chev. I can't say but it is, Madam; tho' the whole is highly agreeable. If your Ladyship and the company think fit, we'll adjourn thither. Where can we be more commodiously situated, whilst our discourse turns upon birds? There we shall have an opportunity of seeing them all, one after another, as they come either to play, or sip on the brink of the little canal that runs through their verdant bower.

Countess. I have seen two new broods there, within these few days, notwithstanding the season is so far advanced. 'Tis a concern of some importance, as they are two species, which I have a great inclination to preserve. Too much company, and too frequent visits, disconcert their measures, and make them sometimes abandon their eggs: However, without any ways incommoding our solitaires, I'll give you as adequate an idea of the structure of their nest, as if they were actually on the table before your eyes.

'Tis a very agreeable amusement to me to observe the resemblance which is apparent in all the nests of such birds as are of the same species; the difference which there is in those of another; and, in short, the industry, neatness, and prudent precaution, which are conspicuous through the whole. As it is not in the power of my little prisoners to rove at pleasure, in search after such materials as are absolutely necessary for the erection of their nests, I take all due care to supply them

them with whatever will, in my opinion, be most agreeable to them. For which purpose I examine all the materials, of which such nests are composed, as some poor children, whom I often send on such sort of errands, bring me from time to time out of the adjacent hedges; and accordingly I amass, in some commodious nook or corner of the aviary, a whole heap of little splinters of dry wood, the bark of trees, of dry leaves, hay, straw, moss, cow's-hair, horse-hair, down, wool, silk, spiders-webs, feathers, and a thousand other materials of the like nature, as are serviceable in the structure of their nests. It would make any one smile to see my little captives resort to this publick mart: One comes to purchase a piece of moss, another a feather, and a third struggles hard for a straw. Sometimes one shall bid more than another for a lock of wool; and this now and then creates some little animosity betwixt them: The affair, however, is for the generality soon amicably adjusted; and each carries all she can get to the nest.

I take equal care likewise, that no proper provisions for them shall be wanting: I have accordingly retain'd a purveyor for them who supplies them with worms, caterpillars, flies, and a variety of seeds; and gives them that which he thinks most agreeable in its season. There's a great advantage attends the rearing of them after this manner in a verdant bower. They enjoy a better state of health, act with less restraint, and we have a better prospect of their respective characters and employments.

One species of them build their nests at the tops of trees; another on the ground, and in the grass. But wherever their apartments are situated, they take particular care to have them under some commodious shelter; that is to say, either under some herb, some shady bough, or a double canopy of leaves, from whence the rain may descend, without ever dripping into the nest that lie concealed beneath it. The out-works, or foundation of the nest, consist of more solid and substantial materials. Thorns, reeds, straw, and the thickest moss that can be procured, are made use of for that purpose. On this first lay, in the disposition whereof there is no visible regularity or beauty, they spread and fold, in an orbicular

orbicular form, a sufficient quantity of their most curious materials, which being work'd up very close and compact, secures the aperture of it from the bleak winds, and the access of any insects. But each species has a peculiar taste in the erection and furniture of its lodgment. When the outside is finish'd, they take all imaginable care to embellish the inside with feather-hangings, or to line it with wool, or silk itself, in order to make it warm and commodious for the reception of themselves, and their little brood. When they cannot furnish themselves with such materials, they spare no pains to find out something that will answer the same end: And this observation I made from the conduct of the first thistle-finches which I ever bred. I had accommodated them with nothing but a little hay for the erection of their nest. For want of some silk or cotton, the female had recourse to an expedient, which agreeably surprized me. She set herself to work, and pick'd feather after feather from the breast of the male, without the least opposition on his side; and with the down she had thus robbed him of, hung her whole apartment in a very elegant and artful manner.

Chev. A very surprising circumstance, truly! Who informed that female, that she should deposite her eggs there; and that those eggs would be lost without a proper degree of heat?

Prior. In my opinion, Sir, the art and industry of the creature are as remarkable as her care and precaution. Or if you will not admit that she is possess'd of these good qualities, you cannot but acknowledge, that they are conspicuous in him, who conferred on man the invaluable gift of reason, which extends to every object that surrounds him; and on all living creatures whatsoever, an imitation of that reason, which is limited, indeed, to one single point, but surprising in that very limitation. For is it not an infinite wisdom which directs that bird in her daily labours till her nest is compleated? Who acquainted her that she should lay any eggs; that a nest was absolutely necessary to preserve them from falling, and to bring them to perfection by a genial heat; that such heat would not meet in one center, was her nest too extensive; and that all

her

her young would not have house-room, was it more narrow and contracted? By what means is she informed of its due proportion and extent, and the exact number of her future progeny? Who has regulated her kalendar, that she might calculate her time aright, and not lay her eggs till her nest was finished, and ready for the reception of them?

Count. There is one thing, which I think is still more surprising than all the rest: And that is, the basket-maker has hands and proper tools to accomplish his designs with; the mason has his hod, his trowel, his line and square; but the inhabitants of her Ladyship's aviary, who are universal operators, have no implement to work with, but their bills.

Countess. Indulge me in one whimsical thought, which is just now come into my head. Suppose *Dædalus*, or any other architect you think proper, to be metamorphosed into a bird: Suppose him now to have no hands, no utensils, and no materials; deprived of every thing, in short, but his art and his bill. What will he make of them? Tho' the bird has no other implement than his bill, and no judgment to direct her; yet still there are such marks of art and contrivance in her works, as discover all the regularity of the basket-maker, and the industry and application of the mason. For in the structure of some of these nests, we see the down, the hairs, and the reeds are most beautifully ranged and interwoven. There are other * birds-nests, the respective parts whereof are artfully united and connected by a thread, which is sometimes form'd by the birds with cows-hair and hemp; but for the generality, with spiders webs, which are procured by her without the least difficulty, when these roving insects sally out, and fill the fields with their threads; by virtue whereof, they transport themselves from one place to another, in hopes to find out some suitable companions. There are other † birds, such as the black bird, and the lapwing, or pewee; who, after they have built their nest, spread a small lay of mortar all over the inside, which glews and

* The Titmouse, or Muskin, with a long tale. Derham, Theol. Phys. l. 8. c. 4. rem. 5. Raii Synops. Avium, p. 74.

† Willoughby's Ornithol. p. 140.

and sustains whatever lies below ; and by the help of a little cows-hair, or moss, wherewith 'tis temper'd when fresh made, they erect a perfect wall within ; rather let us call it an habitation handsomely furnish'd, and admirably well calculated to preserve the heat requir'd. As I have stood at my closet-window, I have frequently observ'd the swallow, either beginning to build her nest, or to repair it when demolish'd ; which is quite different, with respect to its structure, from all others. She makes use of no wood, no hay, or bandage ; she knows how to plash, or beat a kind of parget, or rather cement, wherewith she erects, both for herself and her young, a commodious, tight, and decent apartment. She has no pail to hold her water, no wheel-barrow to carry off her sand, or shovel to mix her mortar. I have seen her, however, fly backwards and forwards over the basin in the parterre. She expands her wings, and wets her breast on the surface of the water, then she shakes the dew off upon the dust, tempers them well together, and at last works them up with her bill. But I fear, Sir, I have been too prolix, and trespass'd on your patience. I am conscious of my own weakness, and too partial a regard for the little creatures I have been talking of.

Cher. Let me prevail on your Ladyship to pursue the subject ; I am charm'd with the account you have given us. Pray, Madam, what follows when the nest is finish'd ?

Countess. After the completion of the nest, the female deposits her eggs there ; the number whereof varies according to the species : Some lay but two at a time, others four or five, and some again seventeen or eighteen. The eggs thus deposited, the dam and the male sit upon them alternately ; but, for the generality, that office is the peculiar province of the former. And here 'tis impossible that any one should be so incurious, as not to discern with admiration that powerful impulse of a superior reason, which acts upon these little animals. They have, doubtless, no manner of idea of the matter contained in their eggs, or the necessity there is for their brooding over them, in order to hatch them, nor of the manner in which the whole is actually perform'd : And yet this active, wandering, restless little creature forgets at once

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her natural inclination, and hovers over those eggs as long as is necessary and convenient : The dam puts herself out of her bias, bids adieu to all manner of pleasure, and never stirs for twenty days successively from her brood ; and, in short, carries her parental tenderness and affection for them so far, as to neglect her very food. The male, on the other hand, bears a part, and alleviates the toil she undergoes : He brings his faithful partner the best provisions he can procure for her ; he is indefatigable, and travels backwards and forwards without intermission ; in a word, he waits on her every now and then with some delicious morsel, ready dress'd for her, in his bill : His service is attended with all the courtesy and complaisance imaginable : If he discontinues his care and concern for her, 'tis to entertain her with his melodious notes ; and he acts with so much vivacity and cheerfulness, with such an air and grace, when he either takes his leave, or makes his approach towards her, that we are at a loss to determine, whether the incessant vigilance of the little mother, or the officious restlessness of her mate, are the justest objects of our admiration. The Chevalier may possibly be pleas'd with a detail of the anxieties and cares they undergo in the culture of their young ; but before I enter upon that topick, I think it will be proper to give him an account of what is contained within the egg, as well as the manner in which the young one is form'd, and how it afterwards breaks through its confinement. An egg, it must be allow'd, is but common food ; but when dress'd *a-la-mode* may pass for an elegant entertainment. Can any one of this learned assembly inform me what an egg is ?

Count. I might easily trespass upon your patience, by expatiating here with too much anatomical exactness ; but shall content myself with giving you a plain, tho' just answer to the question propos'd.

We * may form an adequate idea of the egg of the smallest bird that flies, by that of a hen, where the parts are more large and conspicuous. One may easily distinguish the yolk which lies in the heart of it, the first white substance that encompasses the yolk, and a second white

* Malpighi de Ovo incubata. Willoughby, Ornithol. l. 1.

white substance wherein the mass swims in the middle : We can likewise discern the ligament which support the yolk towards the center of the egg, and the various membranes that invest it ; one whereof wraps up the yolk ; another, the first white substance before-mention'd ; a third and fourth surround the whole ; and, in the last place, we observe the shell, which secures and preserves all the rest. The internal parts are form'd first ; the shell last, which hardens by slow degrees. 'Tis an effusion of a considerable quantity of salts, which flow from the humours of the female, and which the heat fixes, and consolidates all round the egg for the formation of a crust, the office whereof is two-fold ; one enables the mother to deposite the egg without crushing it to pieces ; the other † to protect and defend it from all accidents, till 'tis duly form'd and strong enough to break through its confinement. It may be said, that the egg is by nature assign'd to perform the function of the teat ‡ with milk, that nourishes and sustains the young of other animals ; because the chick enclosed within the egg, like a nymph that lies concealed under the skin of a small worm, is nourish'd at first by the white substance of the egg, and afterwards by the yolk, when the little animal has gather'd some strength, and its parts begin to knit. 'Tis under this membrane, which thus encompasses the yolk, that the little speck or white spot is form'd, which is nothing more than the seed, or point, wherein the chick is enclosed. There is a vital principle infused into those eggs, which have that speck or spot lodged in them. Such, however, as are laid by the hen, without any intercourse or acquaintance with the cock, contain in them an unprolific nourishment only, which will never become living creatures. The chick, under its form of a little worm, always presses forwards to the yolk, and when there, ascends immediately to the top of that side to which the genial warmth of the dam attracts it. However, since the young might be immediately destroy'd by the removal of the egg, and the loss consequent thereupon of that degree of heat which is requisite to support it, the yolk is sustain'd by

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† Leuwenhoeck's Ep. Phys. 40.

‡ Willoughby, *ibid.*

two ligaments, which we always find at the opening of the egg, and which fasten it on both sides to the common membrane that is glew'd to the shell. Were we to draw a line from one ligament to the other, such line would not pass directly through the middle of the yolk, but above the center, and cut the yolk into two unequal parts; so that the lesser part, wherein the seed is contained, is of necessity raised towards the belly of the bird that hatches the egg; and the other part, being more gross and ponderous, always descends as low as the bands will permit it: 'Tho' the egg therefore be removed, the young sustains no hurt or prejudice therefrom; but enjoys, let what will happen, such an enlivening warmth, as puts all in action that surrounds it, and by slow degrees accomplishes the disengagement of its parts. As it cannot slide down any lower, it supports itself at first in perfect ease, with that delicate, liquid white, which is suitable to its tender nature; but some short time afterwards, it subsists on the yolk, which is a more solid and substantial aliment. When its bill begins to harden, and the little animal grows restless and uneasy in its too narrow situation, he uses his utmost efforts to break down his prison-walls, and by repeated essays at last procures his enlargement. At his first fall he is fully replenish'd with the yolk, which is still his principal nourishment and support, till he has strength to stand upon his legs, to go from place to place to seek for provisions, or till his parents themselves come to supply his necessities.

Prior. From what his Lordship has observed, that some of these young ones, when they disengage themselves from their confinement, are nourished and supported for some time by their parents; and others, at their first excursion, are obliged to shift and provide for themselves; a thought has occurred to me, which I'll communicate to the Chevalier. Such birds as are obliged to nourish and tend their young after they are hatch'd, have very seldom a numerous progeny; whereas, on the contrary, those birds, whose young will take care of themselves as soon as disengaged from their shells, have sometimes eighteen or twenty in a brood, and sometimes more. Of this last species are quails, pheasants, partridges,

tridges, and hens. Now, Sir, tell me the reason why the female, that supports her young for some time herself, has so small a family; and she, that acts only as a guardian, but not a proveditor, has such a numerous progeny? Do you ascribe this difference to the good œconomy of the dam, or do you impute it to the caprice of chance?

Chev. This cannot, I think, be attributed to the latter; nor to any thing less than an over-ruling Providence, that directs every thing to the best advantage. The dam that is so encumber'd, as you observe, has seldom, if ever, a numerous progeny. Were it otherwise, both the male and female would be miserably harass'd and fatigu'd, and their young at the same time be but indifferently provided for. As to such dams as are only guardians, and walk at the head of their little ones, they can conduct and superintend twenty as well as four. We have daily demonstrations of it before our eyes.

Countess. 'Tis true, Sir; but how few are there, whose eyes are open to such demonstrations! You have open'd, indeed, mine to another truth, which I was not conscious of before. You take notice of one set of young who are supported by their parents, and of another who at their first sight of day provide for themselves; but which way do they procure their daily subsistence? Have they any particular market, in which they are sure of finding proper supplies? And how comes it to pass, that the cries of the former, who are confined to their nests, are heard upon the spot? Has the parent of these helpless animals a magazine, from whence he can furnish them with provisions from day to day?

Chev. They have all one common parent, Madam, by whose goodness they are fed.

Prior. He opens the grand treasury, or store-house, of the fields, from whence he provides for all of them according to their several necessities. There they find not only caterpillars, worms, and flies for their young; but in their season, beetles, snails, and grain of various kinds, on which they daily subsist, when they have gather'd strength. Frogs, lizards, serpents themselves, and such

other

other animals, as we conceive to be most malignant and pernicious, are look'd upon as a regale, or a delicious morsel to the storks, and some other species of the feather'd kind. The Almighty opens his hand, and by his boundless munificence all animals are preserved.

Countess. I shall give you another instance of God's goodness and bounty, wherein we ourselves are personally concern'd. Such birds as are either destructive to us, or for which we have little or no occasion, are those which increase and multiply the least. On the other hand, those whose flesh is most wholesome and whose eggs are most nutritious, are exceedingly prolific. The hen alone is a little treasure for a man: There's scarce a day passes but she makes him a valuable present. If, as sometimes it happens, she ceases to furnish her master's table, 'tis with no other view than to stock his court-yard with new inhabitants. For all which repeated services she requires no other gratuity, or acknowledgment, than the fragments of his table, and the refuse of his barn. 'Twould be an act of the highest ingratitude, to be insensible of the value and importance of so generous a domestick. Let us drop this head, however, and return to our birds.

I suppose the eggs hatch'd, and the young ones disengaged from their confinement. What a load of cares are the poor parents charged with, till their little offspring are capable of shifting without their assistance! Till then they feel the weight of a family. Eight they find must be provided for instead of two. The linnet and the nightingale are then as industrious and careful as the rest. Adieu to musick; they have then no time to spare or spend in singing; at least they very seldom indulge themselves in it at that season. Their necessities are then very urgent; they are indefatigable in their pursuit after provisions: Now the male, then the female, and sometimes both sally out together. They rise before the sun; they distribute what they get with the utmost impartiality; each has an equal portion in its turn. This fondness of the dams towards their tender offspring, has such an influence over them, that it even changes their natural disposition: New duties create new inclination. 'Tis not enough to find provision for them; but they must

have a watchful eye over them, and defend and protect them, study what is most for their interest and advantage, make head against all such enemies as attempt to invade them, and run the hazard of their lives for their sakes, when drove to the extremity of an engagement. Observe the conduct of a hen with a brood of chickens round about her, and you'll find her a new creature. Her tenderness and affection for them alter her very nature, and correct her imperfections: Before she was voracious and insatiable, but now abstemious and frugal: If she casts her eyes on a grain of corn, a crumb of bread, or any thing, tho' never so considerable, that is capable of division, she will not touch the least portion of it; she gives her numerous train immediate notice of her success, by a peculiar call, which they all understand. They flock in an instant around about her, and the whole treasure is appropriated to their service. As for her own part, she is very incurious, and contented with any thing she can pick up. This indulgent parent of theirs, tho' by nature timorous, and apt to fly from the least animal whatever, when marching at the head of her little troop, is a perfect heroine, is fearless of all danger, and will fly in the face of the fiercest mastiff. Nay, her new dignity inspires her with such a surprising intrepidity, that, 'tis thought, were a lion to approach her, she would venture to oppose him.

Not long since, I saw one of these animals in another situation, but equally entertaining. I order'd some duck-eggs to be laid under her, which were hatch'd in due time, according to my wish. Tho' her young, when they burst their shell, appeared in a different form from her usual brood, yet she still imagined herself to be their parent, and was therefore as fond and indulgent of them, as if they were her genuine offspring: She gather'd them under her wings, kept them warm, and walk'd about at the head of them, with all the authority and prerogative of a parent. Her little train had hitherto shew'd her all the respect she could reasonably desire, and punctually obey'd her orders. At last, however, unfortunately for her honour, she march'd with them to the brink of a brook: In a moment all her little attendants plunged into the water: The mother threw her-

herself into a perfect agony ; she follow'd them with her eyes along the bank-side, gave them her advice, highly blamed their rash and dangerous proceedings, called aloud for help, and acquainted all she met with the misfortune that had attended her. She returned with precipitation to the water-side, and once more earnestly entreated these imprudent little creatures to make the shore : But all to no purpose ; the ducklings, over-joy'd to find themselves in their own element, and perceiving they had strength sufficient, from that moment excused her from taking any farther care about them, and returned to her no more.

Prior. I beg leave to interrupt your Ladyship one moment, and to ask the Chevalier in what school those ducklings were educated, and from whom they had learnt that the water was their proper element ? This intimation could not possibly be given them by their foster-mother.

Chev. I am sensible, Sir, that your observation is just. This inclination to the water is implanted in the very nature of the duck : 'Tis the direction of the Deity himself.

Prior. We cannot, in the circumstance before us, possibly mistake the impression of the Supreme Being, which anticipates all lectures, and corrects education itself.

Countess. I must amuse the Chevalier with one instance more of a mother's anxiety, of which I have been frequently an eye-witness. 'Tis very observable, that a turkey-hen, when at the head of her brood, will sometimes send forth the most hideous scream that ever was heard ; tho' what should be the real cause or design of her doing so is unknown. However, her young, immediately upon it, skulk under the bushes, the grass, or whatever else offers, for shelter and protection : They vanish, as it were, in a moment ; and in case their retreat is not, as they imagine, sufficiently safe and secure, they'll stretch themselves at their full length upon the ground, and lie for a quarter of an hour, and sometimes longer, as motionless as if they were dead. In the mean time, the mother directs her eyes upwards with an air of horror and confusion ; she redoubles her sighs, and screams in the same frightful manner as before. Such as are curious, and observe the perplexity and solicitous attention of this mother,

ther, cast their eyes into the air, to find out, if possible, the cause of her inquietude; and, by looking wishfully, discover a black spot just under the clouds, but are unable at first to determine what it is. This is a bird of prey; which, altho' at too great a distance to be distinguish'd by human sight, cannot escape the vigilance or penetrating eye of this indulgent mother. 'Tis this that creates her fears, and puts her whole tribe in such an agony. I have seen one of these animals continue in such a violent agitation as before-mention'd, and her whole brood pinned down, as it were, to the ground, for four hours together, whilst their formidable foe has taken his circuit, has mounted, and pitch'd down directly over their heads. But at last, if he disappears, and happens to overlook them, the parent changes her note, and sends forth another cry, which gives new life in an instant to the whole trembling tribe. They all flock round about her, clap their wings for joy, pay their duty and address to her, have a hundred things to tell her, and, in all probability, with pleasure relate the dangers to which they were expos'd, and had so happily escaped. After this, they unanimously call down the most direful imprecations on the tyrant's head.—But I fear, Doctor, the subject grows too sportive for you, and that I have trespass'd on your patience with my tedious tale.

Prior. Not in the least, my Lady, I'll assure you. There is not one single circumstance in your whole narrative, but what is highly worthy the attention of the curious. For who, pray, could inform this mother of an approaching enemy, that had never injured her, and hitherto had shewn no act of hostility in the country? And which way could she discover this unknown bird of prey at such a prodigious distance? Moreover, what private instructions had she given her young family, that they could so readily distinguish, as occasion required, between the intention of one cry and the other, and to regulate their conduct by her language? Tho' your Ladyship is pleas'd to call this account of yours too sportive, and a tedious tale; yet, in my opinion, 'tis more instructive and entertaining than some very serious dissertations.

Countess.

Countess. You must give us one, Doctor, for all that, on the structure and flight of birds.

Prior. With all my heart, Madam. 'Tis a subject that I am peculiarly fond of.

The * body of a bird is neither very massive, nor equally thick and solid in all its parts; but well disposed for flight, sharp before, and increasing gradually till it has acquired its full bulk, or dimensions. Thus form'd, the animal is much better qualified to wing away, and steer his course through the regions of the air.

That it may be the better enabled to take a long tour, in which passage such provisions as might be agreeable cannot always be procured, and to qualify it for spending the long tedious winter-nights without the least refreshment, nature has furnish'd it with a bag, which is generally called its *crop*, just under its throat; and in this magazine he lays up a stock of provisions. The fluid †, wherein its meat swims, is a great help to its first digestion. The gizzard, into which but a small quantity of the nutriment enters at one time, performs the rest, and frequently, by the assistance of some little rugged stones, which the bird swallows, in order the better to break such nutriment to pieces, and perhaps to keep the passages more free and open.

Tho' the bones of birds are solid and substantial enough to sustain and keep their bodies together, yet they are notwithstanding so small and hollow, that they make no considerable addition to the weight of their flesh.

The distribution of the whole plumage is extremely artful, and serves not only to support the bird, but to secure and defend it from the injuries of the weather. Tho' the quills of its feathers are firm, yet they are very light. By the firmness of them, it is enabled to cut the air with a proper force; and by their lightness, in proportion to their growth, it can rise at pleasure; whereas otherwise it would have whelm'd downwards. In short, this hollow quill takes up a large surface, and yet its gravity is inconsiderable; which puts the bird almost in equilibrium with the air. The feathers behind are

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inverted,

* Derham's Theol. Phys. l. 7.

† Willoughby's Ornithol. l. 1.

inverted, and disposed one over another, in the exactest order that can be imagined. That part of them which is nearest the body, is furnish'd with a soft and warm down, and that next the air with a double row of beards, something longer at one end than at the other: These beards are a range of little, thin, flat plates, disposed in as direct a line as if their two extremities had been cut with a pair of scissars. Each of these plates is itself a quill, or basis that supports two other rows of plates, which are almost imperceptible, by reason of their minuteness, and stop up perfectly close all the little intervals, or crannies, through which the air might find a passage. Besides, the feathers are so ranged, that the row of little beards of the one glides, plays, and discovers itself, more or less, under the large beards of the feather that lies over it: A new range of lesser feathers serve as a covering to the quills of the larger. As therefore the air has no influence over any part whatever, the impulse of the feathers on that fluid becomes very strong and efficacious.

But as this œconomy, so absolutely necessary, might frequently be obstructed by impetuous rains, the Great Author of nature has provided an expedient for them, whereby their feathers are as impenetrable to the waters, as by their structure they are to the air. All birds in general have a bag replenish'd with oil, which in shape is like a dug, or teat, and is situated at the extremity of their bodies. This teat has divers little orifices; and when the bird perceives her feathers to be dry, dirty, wide-gaping, or likely to be wet, she squeezes this teat with her bill, strains from thence an oil, or viscous humour, which is reserved in the glands. After this, having drawn her bill successively over the greatest part of her feathers, she oils and dresses them, gives them a lustre, and fills up all the vacancies with this slimy matter. When she has thus done, the water rolls off her back, and finds all the avenues to her body absolutely closed. The poultry in my court-yard, who live for the most part under a covert, are not furnish'd with so large a stock of this fluid, as those birds that reside in the open air: And this is the true reason why a hen, when she's wet, makes such a scurvy figure; whereas,

whereas, on the contrary, swans, geese, ducks, more-hens, and all such other birds as nature has directed to live upon the water, have their feathers dress'd with oil, from the very first day of their existence. Their magazine contains a stock of that oil, in proportion to the necessity they lie under of consuming it, which is for ever returning. Their very flesh contracts the flavour of it; and 'tis obvious to the observation of every one, but such as are perfectly incurious, that they make a constant practice of oiling their feathers.

If there is such wisdom display'd in the structure of the feathers, there is as much beauty in the play of the wings and tail, by virtue whereof it traverses the air with pleasure. Nothing could possibly be more artfully placed than the wings are; they form two levers on each side, which keep the body in an æquilibrium. At the same time they perform the office of oars, which, by pressing hard on the element which resists them, cause the body to advance in an opposite direction.

The tail is a counterpoise to the head and neck; it serves the bird as a rudder * to steer her course by, whilst she rows with her wings: This rudder, however, is not only intended by nature to keep her body in an æquilibrium whilst she flies, but to enable her to ascend, descend, or direct her course which way she pleases; for no sooner is the tail directed to one point, but the head is turned to the opposite quarter.

Chev. Tho' I cannot rightly comprehend how these birds perform their flight, yet I am fully persuaded that we ourselves might, by practice, learn to fly as well as they: The birds have taught us plainly the method which ought to be observed.

Prior. We have, doubtless, in our legs and arms, the principle of motion: We have likewise in our feathers of birds, our fine linen, and our oil, sufficient materials, to all outward appearance, for the making ourselves such commodious wings, as should be capable of cutting and impelling the air, without the least danger of its finding a passage through them. The birds, indeed, as you observe, have furnish'd us with a plan of the

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action.

* Willoughby, *ibid.*

action. At first view, it seems an invention naturally laid before us; and we imagine, that by a few essays, and a little thought, it might be brought to perfection: But 'tis my firm belief, that God Almighty has thrown an obstacle in the way, that is absolutely insuperable, out of a tender regard for the welfare of mankind; inasmuch, that notwithstanding attempts of this nature have been so frequently made, not one as yet has ever met with the desired success. The art of flying, in short, should it ever be found out, would prove the greatest misfortune that could possibly befall us.

Chev. Excuse me, Doctor, for being of the quite contrary opinion: the invention would, doubtless, save us a world of trouble. We could come by the intelligence we wanted a great deal sooner. Could we but once find out the art of making a small machine, we should soon, by a little practice and improvement, erect a large one. We should not only be capable of travelling through the air ourselves, but of conveying what effects we thought proper through that element. By virtue of this invention, trade and commerce, Sir——

Prior. You have an admirable penetration, Sir, I must confess. You have a peculiar talent at finding out the numerous advantages that must of necessity arise from so profound an invention. But, to be serious, Sir, the advantages you propose would never compensate for the disorders that would inevitably ensue.

Count. The Prior's observation is, beyond contradiction, very just. Were men once capable of traversing the air, there would be recess, how lonely soever at present, but what would be exposed to envy, malice, and inordinate desires. Our habitations would be turned into so many theatres of blood-shed and rapine. What measures could we take to secure ourselves against an enemy who would be able to surprize us both by day and night? How should we preserve our money, and other valuable effects, or the fruits upon our lands, from the insatiable avarice of a band of robbers, provided with good arms and ammunition to plunder our houses, and as good wings to convey away their booty, and avoid our pursuit? This kind of trade would be the refuge of every necessitous profligate and idle vagrant.

Prior.

Prior. Besides, this art would introduce nothing but anarchy and confusion. We should be obliged to fly from our houses in the city, and our seats in the country, to be buried in subterranean caverns, or imitate the eagles and other beasts of prey. Like them we should withdraw to inaccessible rocks and craggy mountains, from whence we should dart down either upon the fruits of the earth, or such animals as would best gratify our voracious appetites. That call obey'd, we should quit the plain, and soar up to our gloomy caves and charnel rooms again.

Countess. Gentlemen, you make me shudder at the thoughts of your art of flying; and may the heaviest imprecations that imagination can devise light on the head of him, I say, who shall first attempt to reduce it into practice! Pray let's have no farther discourse on your melancholly subterraneous caverns. Are you convinced, Chevalier, of the fatal consequences that would attend the invention for which at first you was so strenuous an advocate?

Count. Make yourself easy, my Dear, in this respect. We need be under no apprehensions of danger from an art that, I'll venture to affirm, is absolutely impossible to be put in practice. Nature herself has form'd an impediment against it, which in some measure can never be overcome, by the vast disproportion that there is between the gravity of the air, and that of a human body. In short, the most profound mathematicians allow, * that it is as impracticable to invent a flying machine, as to find out the perpetual motion.

Countess. Pray, Gentlemen, shall we resume the subject of birds to-morrow?

Count. We can never be at a loss, my Dear, as there is no want of a variety: The difficulty lies in confining ourselves within due bounds. What shall be the articles of our next conference?

Prior. Let each of us, my Lord, chuse for ourselves, and please our own taste.

Chew. If the Prior will be so good as to be security for me, I'll promise to bring my part of the collation.

Countess.

Countess: For my part, Gentlemen, I promise you before-hand a bird that was never found in any country but *America*. You never saw a more diminutive, and yet, I'll venture to say, a more beautiful creature in all your days. And if you think that's less than comes to my quota, or share of the entertainment, I'll bring an ostrich with me to make good the deficiency.

B I R D S.

DIALOGUE XI.

The Count and Countess, the Prior, and the Chevalier.

Chev. I Took the liberty, yesterday in the evening, to spend an hour in his Lordship's closet, where I gratify'd my curiosity with turning over Mr. *Willoughby's* book of birds, which lay upon the scrutore. I ran over all the prints, which are beautifully engraved, and coloured after the life. My thoughts were so intent on the various figures which I saw there, that I could not rest. Some were drawn with monstrous bills, and legs of an immoderate length; others again with bills and legs as remarkable for their minuteness. Now, Gentlemen, since both the one and the other have nothing more to do than to traverse the air in pursuit of their food, why should there be such a surprising diversity in their wings, beaks, talons, and, indeed, in every part? Are all these various forms the pastime only of nature, or are they conferred upon them to answer some useful purpose?

Count. The vast disproportion which you observe in the beaks of these animals is, by no means, correspondent

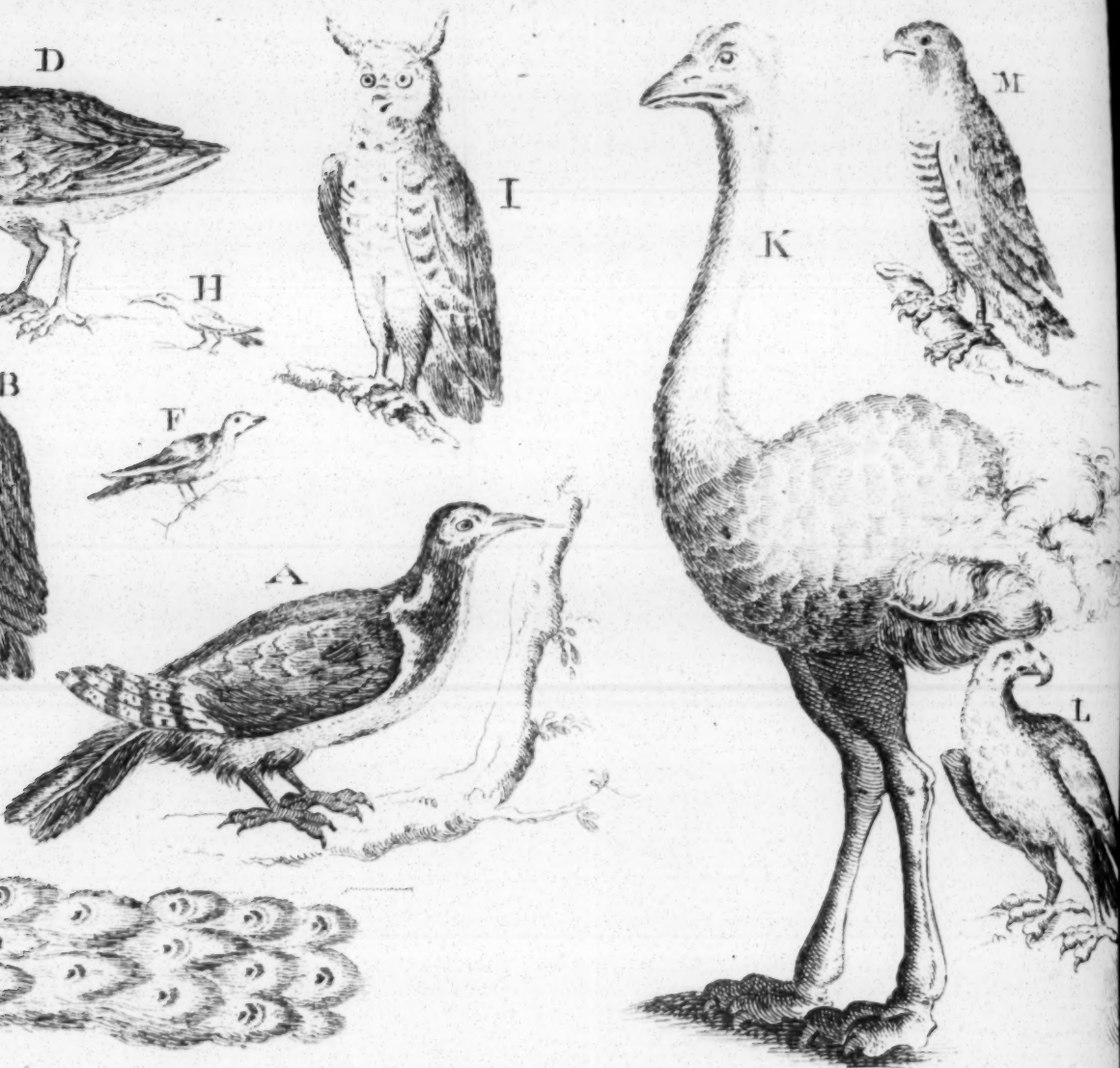
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with that difference of noses which is conspicuous in human faces; for in the latter an inch, little more or less, is all the variation that there is between them. As to the rest, the structure and function of it is exactly the same: Whereas, in the various species of animals, the beaks, the claws, the extent of their wings, and, in short, each individual part of their bodies, is for the generality adapted to their several necessities. There are, as it were, so many utensils, appropriated to the nature of their work, and the manner in which they live. As for instance: The sparrow, and most other birds of the smaller size, are principally sustain'd by the little grains, which they either pick up in our houses, or the fields. They have no efforts to make, either for the procurement of their food, or for the breaking it in pieces; for which reason, tho' the dimension of their beaks, neck, and feet are but very small, yet they fully answer the end for which they were design'd. The case, however, is widely different in regard to the woodcock, the snipe, the curlew, and divers other birds, who seek for their subsistence either deep in the earth, or in the mud, from whence they extract such little shell-fish and worms as are their favourite food. Now nature has furnish'd these animals with a longer neck and bill than ordinary, whereby they are enabled to dig deep into the ground, or to rake to the bottom of shallow waters for their food.

The wood-pecker, who lives after a quite different manner, is, for that reason, of a quite different form: His bill is of a considerable length, and very solid and substantial: His tongue is as sharp as a horn; it is fortified likewise with several little points, and always cover'd over with glew towards the extremity: The legs of it are very short: It has two talons before, and two behind; all of them bearded like hooks. All this furniture corresponds with the manner in which it lives, and secures its prey. It principally subsists on worms, or such other insects as reside in the heart of particular boughs; but for the most part in the bark of rotten wood. Nothing is more common than to find numbers of these reptiles lodged deep under the bark of our large billets. The wood-pecker could never be able to grasp

the branches to which he fastens, was he not furnish'd with hooked claws. Long legs would be of no service to him, in obtaining what he seeks for under the bark. A sharp, strong bill, however, is indispensably necessary, because he is obliged, by pecking from one place to another, along the branches, to find such places out as are rotten and decay'd. If the branch sounds hollow he proceeds no farther, but breaks in shivers both the bark and the wood with his beak. After this he darts it into the cavity he has made, and then sends forth a loud cry, or rather whistle, into the hole of the tree, in order to disperse the numerous insects that lie dormant there, and to put them in a hurry and consternation. When he has so done, he darts his tongue into the orifice he has so made; and by virtue of those little sharp points with which 'tis furnish'd, and the viscous matter with which it is plaister'd over, he drags out all the minute reptiles which she finds, and regales on the booty.

The heron, who is just the reverse of the wood-pecker, is mounted a considerable height: His legs and thighs are very long, and scarce a feather is to be seen upon them: His neck and beak likewise are of an immoderate length, and the latter very sharp, and indented at the end. Now can any reason be assign'd for a figure, which, at first view, appears so very awkward and grotesque? Yes, a substantial one, and that is, this bird subsists on frogs, little shell-fish, or such other fish as he can find in those marshy grounds which are situate near the banks of large rivers, or the sea-shore. Of what service would feathers on his legs or thighs be to him, in order to wade through the water or dirt? Long legs; however, are absolutely necessary, since they enable him to run along the shores, where the fish resort in shoals, in quest of their daily food. By the help of his long neck and bill he can pursue and snap up his prey at a considerable distance. The indenture, and beards of his beak, are of singular service to him in securing such fish as he lays hold of, which would otherwise make their escape, and glide from him. In short, his large wings, tho' at first view they may seem no small incumbrance to his little body, yet they are of singular service to him in making a speedy passage through

through the air, and carrying ponderous burdens to his nest, which sometimes lies a league or two distant from the spot where he fishes. A friend of mine, who has a handsome seat at *Abbeville*, bounded by a rivulet, well stored with eels, saw a heron carry off one of the largest he ever beheld, notwithstanding all the efforts of the eel to obstruct his flight. What we have advanced with respect to the heron, is applicable likewise to several other species that resemble him.

Countess. This is the first time I ever heard remarks made on the particular uses assign'd to these bills, which before, I must confess, seem'd to me somewhat capricious and extravagant. However, I am now fully convinced that the contemptible idea I had entertained of them was owing to my own want of judgment, and that all our censures of nature are, in effect, concessions of our own ignorance. For which reason, tho' I cannot at present account for the prodigious length of a stork's bill, yet I am fully determin'd not to animadvert or reflect upon it.

Prior. The bird your Ladyship last mention'd digs deep into the earth with it for serpents and adders, which she afterwards distributes amongst her young, on whom the poison of those animals hath no manner of malignant influence.

Countess. The due proportion of it is now sufficiently apparent; and in the discussion of this topick, I shall be able, I presume, to find out the true reason why those swans, which are swimming on the canal below, have such long necks and long beaks. Swans, geese, and ducks are for ever raking in the mud, or slime, at the bottom of the water; and, 'tis plain, for no other reason, but because they find there a considerable quantity of those little worms you were talking of some time ago. As they are always swimming on the surface of the water, 'tis absolutely necessary that they should be provided with a long neck, in order to reach the bottom. And for the same reason should not they be furnish'd likewise with a large beak, to enable them to take in a large quantity of mud or gravel, and to take possession of all the worms they find amongst it, by a separation of them from the viscous matter wherein they

they are found? Instead of these crooked talons, with which such birds as regale themselves on flesh are enabled to seize, turn, or return their prey, and to fasten themselves on those branches whereon they once settle; swans, geese and ducks have flat feet, or large paws, with films or skins, which they extend as fish do their fins, and with which they impel the water one way, in order to advance themselves another. You see, Doctor, I talk very profoundly. There is some difficulty, let me tell you, in the explication of all this.

Prior. The merit, Madam, of natural philosophers, amongst whom your Ladyship is at present enroll'd, does not always consist in clearing up such points as are difficult and abstruse, but in prying with a curious eye into such matters as others pass over unobserv'd, and very often look upon as the objects of contempt. Nothing is more uncommon, I'll assure you, Madam, than to meet with persons addicted to thinking.

Countess. We women, Doctor, are exempted from that trouble; and thinking seems to be a qualification, which you men seldom expect from us.

Prior. Our indulgence, 'tis true, is very great in that particular: But you, Madam, have no occasion to complain of us.

Countess. Excuse me, Sir; but our whole sex in general have just grounds for complaint. The misconstruction which is put on that indulgence is an irreparable misfortune to us; for 'tis that, Sir, which renders us vain, remiss, incapable of elevation, ignorant, injudicious, and irresolute: If one of our sex preserves her understanding from the common wreck, and shews the least symptoms of solidity and penetration, she's look'd upon as a miracle. As to the ancient languages, indeed, the loss of them is not much regretted. Neither have I any great notion of those gloomy sciences, which by a too close pursuit of them, render us useless to society. Our hard fate, however, is justly to be lamented, in that we have no adequate idea of the fundamental articles of our most holy religion; that we have but little knowledge of the world, and are perfect strangers to the works of our Great Creator. I own my happiness in meeting with his Lordship. He was the first that did me the justice to believe

believe that I had my share of reason, as well as others. 'Tis evident, from his conversation, that he thought so: And is it not paying me a substantial compliment, that he judges me a proper person to attend his philosophical lectures; to know why a tree shoots up in such or such a shape; be acquainted with the cultivations of the earth, and the qualities of plants? Since his Lordship has brought me to a habit of thinking, and employing my time to the best advantage, I have look'd upon this rural seat of ours as a terrestrial paradise. I now enjoy a variety of beauties and treasures, wherewith nature abounds, which before were to me, as I was wholly a stranger to their very names, of no manner of importance.

Count. Your complaints against our sex, my Dear, are too justly grounded. There are some Ladies, however, in whom good sense is the shining quality, and whose judgment is as solid as 'tis refin'd: But whether these accomplishments are owing to a happy education, or whether their superior genius compensates for the errors and imperfections of a weak one, I shall not determine. —But see, my Dear, this digression of ours has almost lull'd the Chevalier asleep.

Countess. He is not much to blame; for I promis'd him a couple of foreign birds, and instead of it I have introduc'd a lesson of morality, which is not the mark he aims at. —Come, rouze, Chevalier, and I'll acquit my self honourably of my engagement. — Know then, that what I am now going to tell you, I had from a merchant of *St. Malo*, a great traveller, who paid us a visit soon after his return from *America*, and the coasts of *Guinea*. He made us a present of four humming-birds, and two ostriches eggs; and at the same time acquainted us with several circumstances relating to those animals, which I'll endeavour to recollect, as they were very particular, and, in my opinion, very entertaining.

The * humming-bird is to be met with in no country but *America*, and may be looked upon as one of nature's master-pieces; not only on account of its beauty, but of its manner of life, and the minuteness of its parts.

Tho'

Tho' the dimensions of it do not exceed the bulk of a large fly, yet the plumage of it strikes the eye in the most agreeable manner, and glows with all the colours of the rainbow. His neck is dyed with such a blushing red, that 'tis frequently mistaken for a ruby. The belly, and the down beneath the wings, are as yellow as gold, and its green thighs surpass the emerald. Its feet and bill have as fine a gloss, and are as black as ebony. Its eyes appear like two oval diamonds, resembling, in colour, the most polished steel; and its head is a lively green with an intermixture of gold, the lustre whereof is beyond expression. The males have a little tuft, or tossel, on their heads, in which all the beauteous colours that shine so conspicuous throughout the whole, are assembled and concentrated. These birds fly with such a velocity, that one may more properly be said to hear, than see them. Their principal sustenance is, as we are inform'd, the dews and juices of the most fragrant flowers. These they extract with their little tongues, which are much longer than their bills. This little instrument performs the office of a trunk, which they contract at pleasure, and infold within their beaks, as in a case or scabbard. This beak, tho' no larger than a fine needle, renders them formidable even to the large birds there called *Grosbeaks*, who make it their business to devour the young of the humming-bird in their nest: If, however, their dam, who is a little heroine, happens to spy one of these cowardly invaders, he flies before her, and cries with all his might, as dreading to feel the weight of her just resentment. The humming-bird closely pursues him, and if she once overtakes him, lays fast hold of him with her little talons under his wing, and wounds him with her pointed beak, to that degree, that he's obliged to decline the combat, and submit to her superior power.——Open that little box, Sir, and you'll find two of these little agreeable creatures, who, tho' sufficiently dried, preserve some part of their variegated colours. You'll find they are fastened, or hung by their little feet to a small gold ring, in the form of pendants; for the ladies of *Mexico* wear them in their ears: And it must be allowed that they exceed the richest pearls in point of beauty.

Chloe

Chev. These are birds in miniature, indeed! Your Ladyship's butterflies can't shew a greater variety of the most lively colours.—How deliciously they smell too! Pray, Madam, is this delightful odour natural to them?

Countess. Some are of opinion, that 'tis owing to the rich juices of those fragrant flowers on which they feed: But our friend from *St. Malo* rather thinks, that it proceeds from the ambergreese, or odoriferous gum in the cotton, with which they are stuffed in order to preserve them.

Chev. In all probability, Madam, your friend is in the right—I hope your Ladyship will now be so good, as to entertain us with your particulars in relation to the ostrich.

Countess. The ostrich, * Chevalier, is one of the largest birds that nature ever produced. There are more of them in *Africa*, than in all the parts of the world besides. Her head, when in its natural situation, rises as high, and sometimes higher, than a man on horseback. Her head and beak resemble those of a duck; her neck, tho' much longer indeed, is something like a swan's. As to the make of her body, it bears some resemblance to that of a camel, having, like him, a large protuberance, or rising on her back. Her wings are exceeding strong, but too short for flight; and of no other service to her, than as sails, † or oars, to enable her to cut and impel the air, which, however, when she runs, adds an exceeding velocity to her motion: Her legs and thighs are somewhat like those of the heron, allowing for the vast disproportion between them, in respect to their size. Her feet rest upon three claws, armed with sharp horn, to render her march more easy and expeditious.

Her eggs are about the bigness of an infant's head. The shell has veins, like marble, drawn over its surface, shines bright, and is beautifully polish'd. I'll oblige you, Chevalier, with the sight of those two, of which our friend, the merchant, made us a present. The ostrich, like a weak, thoughtless creature, buries them in the sand, and leaves the care of hatching them, as we are inform'd,

* Willoughby's Ornithol. lib. 2.

† Diod. Sicul. lib. 3.

inform'd, to the genial heat of the sun. This inattention and remissness, which seems to argue the want of affection for her offspring, has brought an odium on her character. In * all countries, where this animal is known, when any one would describe a parent, who shews no thought of, or indulgence towards her children, the ostrich is introduced by way of illustration.

Some † travellers, as our merchant informs us, have endeavoured to palliate this gross neglect of hers, and assert, that she takes particular care to leave a sufficient quantity of worms near her eggs, for the sustenance and support of her young, as soon as they are disengaged from their confinement; others affirm, that they have observed a peculiar discerning faculty in this animal, which induces her to warm ‡ such eggs, with all the care and precaution imaginable, as have a vital principle infused into them, and to reserve the rest as proper aliment for her young as soon as hatch'd.

This, however, carries with it the air of fiction; for 'tis evident, that the ostrich is not endued with that prudence and precaution as other birds. She leaves her eggs in the high-way, to be trodden under foot by the first passenger; which is, doubtless, an incontestable mark of her indiscretion. There is another instance, however, to be produced, that will sufficiently demonstrate her folly and want of discernment. When she is pursued by any sportsmen, she flies to hide her head, but more particularly her eyes, behind a tree. Tho' her whole body is exposed to open view, yet as she sees no one in pursuit after her, that's sufficient; and she foolishly imagines that she's then out of danger.

Chev. Is the notion true, my Lord, which I have heard some persons advance, that these birds will not only eat, but digest the hardest metals?

Count. That they will swallow down little bits of iron, as other birds do pebble-stones, is doubtless true; but that they digest them is not so. When they do swallow them, 'tis not to receive any sustenance from them,

* Job xxxix. 16. Lamentations of Jerem. c. iv. v. 3.

† Derham. Theol. Phys. lib. iv. c. 15. & lib. vii. c. 4

‡ Ælian. Hist. lib. iv. c. 7. & lib. iv. c. 37.

them, but to bruise, and grind down the food they have before eaten; to mitigate the excessive heat of their stomachs, and by their weight to open the way, or passage, into the intestines.

Countess. Before we have done with the ostrich, as we have given her but a slender character hitherto, let us do her justice, and say what little we can in her behalf. She presents us with the most lovely feathers, both large and long; some white and others black. They are used as ornaments to the testers of beds, noblemen's canopies, and children's caps: They are worn by officers in their hats; and by ladies as fans in their hands. They are of singular service in all our theatres. The heroes there would lose a considerable part, not only of their height, but of their majesty and grandeur, were they deprived of the ostrich's plumes.

Now, Gentlemen, as I have presented you with the least, and biggest bird that nature ever produced, you may take your choice between those two extremes. 'Tis a large field.

Prior. So large, Madam, that, I own, I am entirely lost in it.

Countess. Since one subject is to you, Gentlemen, as good as another, give me leave to assign each member his particular part. As the Prior is a man of good taste, he shall take upon him the description of all such birds, as are most remarkable either for their melodious music, or their curious plumage. However, lest I should be thought to have imposed too heavy a task upon him, he shall be excused, if he'll only favour us with a short account of the nightingale and the peacock; and I think he cannot possibly complain of so reasonable an allotment. His Lordship, as he is an experienced sportsman, shall confine himself to birds of prey; and the Chevalier has given me private intimation already, that he'll entertain us with the birds of passage. These are all the species I can think of at present; except the bat and the owl be admitted amongst the number.

Prior. Of all the various species of birds, we generally look upon those as the most agreeable companions, who are most harmonious, or can prattle most. However entertaining such may prove, they are notwithstanding

standing only foils to the nightingale, whose single voice is more ravishing than the whole choir besides. When we have been entertained with a melodious symphony of instrumental musick, how agreeably are we surpris'd to hear an inimitable violin, without any other hand to accompany it! 'Tis the very same in a concert of birds, after we have heard a full chorus celebrate the Great Author of their being, and proclaim their grateful acknowledgments to him, by whose bounteous hand they are nourished and preserved; what can be a more agreeable novelty than to hear the nightingale in the evening begin to tune her solitary strains, and continue them till the night is far advanced? One would imagine, that he was conscious of his own natural perfections, and that 'twas out of complaisance to us men, as well as to gratify his own inclinations, that he condescends to sing, when all his fellow choiristers are silent. Nothing animates him so much as to find all nature hush, and still around him. 'Tis then that he composes, and puts all his melody in execution. He wanders from solemn notes to such as are more sprightly; from a smooth easy air, to the wildest notes that can possibly be conceived; from the sprightliest quavers and divisions, to the softest and most melancholy strains. When he has indulg'd himself in those plaintive airs for a short time, he recollects himself on a sudden, and falls into his former vivacity again! Who could be so incurious, as not to want a sight of this matchless musician, that in such an obliging manner ravishes our ears thus every morning and evening? We are all tempted to visit him; but he is so reserv'd that 'tis next to an impossibility to see him. Your virtuosi in all sciences have their capricious humours. We imagine that nature has furnish'd him with an open breast, and indefatigable organs, to enable him to sustain such strong and graceful sounds without intermission; such infinite and just proportions, such a vast compass of musick; and yet at last we find it all proceeds from the throat of a very little bird, who, without instruction, study, or the least preparation, performs all these stupendous operations.

As the nightingale thus ravishes the ear, the peacock, with equal wonder, strikes the eye. 'Tis true, indeed, that the cock, the wild-duck, the halcyon, or king's-fisher,

fisher, the gold-finch, the parrot, the pheasant, and several other birds, are very agreeably array'd ; and that 'tis a pleasure to reflect on the graces, and elegance of their dress. At the first appearance, however, of the peacock, every eye is fix'd with admiration upon him. The air of his head, the delicacy of his shape, the variety of colours which glow all over his body, the starry-eyes, the light and shadows of his tail, the gold and azure that shine conspicuous in every part, the expansion of his plumage, which he performs with all the pomp and pride imaginable, the majesty of his aspect, and the very care and concern which he visibly shews in the display of all his gaudy equipage to the eyes of his numerous spectators, have a peculiar, and astonishing effect. This bird alone is a glorious sight. Could any one imagine now that this bird, thus profusely equipp'd, could in any respect be disagreeable and give distaste ? This, however, is the hard fate of the peacock. He entertains his visitors after the most indifferent manner. He can neither prattle, nor sing. His language is hideous, and shocking to the ear : Whereas the thistle-finch, the linnet, the linget, and the paroquet, without any of the peacock's glaring advantages, live with us sometimes fifteen or twenty years together, and never give us one moment's uneasiness. They are animals that are unaffected, have more wisdom, and are better bred ; and a modest deportment is all in all. A gay out-side show, without any other qualifications to recommend it, contributes but very little towards the rendering society either agreeable or of any long duration.

But perhaps I have been too prolix on the topicks of equipage and musick. I confess they are articles foreign to my profession. His Lordship, however, in his entertainment of us with a dissertation on faulconry, will shine in his own sphere, as 'tis one of the favourite recreations of all our nobility and gentry.

Count. Faulconry, ‡ Sir, is not only the noblest, but the most profitable diversion that can possibly be pursued. Our staunch sportsmen have found out the secret of turning the voracious quality of birds of prey to their own advantage, either by employing them in the destruction

of that species amongst them, which are distinguish'd by the ignominious character of *villains*; because, like cowards, they durst not attack any other creatures, but what are timorous and inoffensive in their natures, (of this pernicious class are the kite and the raven, who make the harmless pigeons, and the young tender chicks their prey) or else by employing them in a war with those birds, who are most delicious and agreeable to the taste, are at the greatest distance from us, and, as the partridges and pheasants do, shun us with the utmost precaution. In the pursuit of these different recreations, the falcon, the ger-falcon, the lanner, the faker, the merlin, the spar-hawk, the goss-hawk, are in great repute. For the generality, however, the first and the last are looked upon as most serviceable, and consequently oftner made use of than any of the rest. All of them, indeed, are very much esteem'd, and are trained up to various flights; † some whereof are directed against the heron, and others against the kite, the curlew, and the owl. As such diversions, however, are attended with an extraordinary expence, they are fit only for kings or princes. The hawk is best qualified for low flights. He is a sly, subtle bird, is always successful in his attempts on the partridge, and never fails of bringing game to the larder. Such gentlemen as are prudent and frugal, leave the falcon to princes, and content themselves with the pleasures which the hawk affords them.

The method observ'd in training them up, and setting them to work, is very agreeable. Such as are appropriated to this service, are call'd either *niaffes* or *hagards*.

The former are those who have been taken out of the nest; the latter, such as have been caught after the enjoyment of their full liberty. Tho' 'tis much more difficult to tame, or break the hagards, yet by patience and artful management, they are taught to obey the call, and, according to our phrase in falconry, made fit for the fray. If they prove too wild and fierce, they are kept up without any provisions whatever; and are not permitted to sleep for three or four nights and days successively, but are never left alone; insomuch that, by degrees, they

† A flight is a complete set of dogs and birds, in order to spring and catch some particular game.

grow acquainted with the falconer, and are ready at all times to execute his orders. What he principally aims at, is to make them settle on his fist; to spring when he throws them off; to know his voice, whistle, or any other signal he thinks proper, and to return to the fist at the first direction. During the time of their instruction, he ties a string or piece of packthread about their feet, of about eighteen or twenty yards in length, to prevent their flying away when he reclaims them; and never gives them their full liberty till they are perfectly disciplin'd, and never fail of returning when recall'd. In order to effect this the bird must be lured; which is a term, perhaps, that may want some explanation.

A *lure*, therefore, is a piece of red woollen cloth, or wood, whereon are sew'd, or nail'd, the bill, talons, and wings of such bird as is judg'd most proper: To this likewise is fix'd a piece of such flesh, as is most agreeable to the bird under discipline. When the falconer proposes to reclaim, or recall him, the lure is immediately thrown out: The sight of the delicious morsel, added to the proper signal, brings him back in an instant. In process of time, the voice alone, without any other artifice, will be sufficient. The different plumage, wherein the lure is embellish'd, is term'd the drawers. When the falconer proposes that this hawk shall fly at a kite, a heron, or a partridge, the drawer is chang'd accordingly. If he be to spring at a kite, the bill and feathers of that bird, and no other, is fasten'd to the lure: The same method is observ'd in the pursuit of any other game. And in order to allure the hawk to the object propos'd, the leg or the wing of a chicken, or some other agreeable piece of flesh, is conceal'd under the drawer, or feathers of the game in view. To this are added, sugar, cinnamon, marrow, and such other tid bits, as are proper to determine the hawk to one flight rather than another: So that afterwards, when he is actually employ'd, he springs on his prey with uncommon ardour. After three weeks or a month's practice in a chamber, or in a garden, trial is made of his abilities in the open fields; but before his master throws him off, he fastens several little bells to his feet, in order to be the better appriz'd of all his movements. The bird is always capp'd; that is to say, his head

is cover'd with a piece of leather, which falls over his eyes, that he may see no other object but that which is propos'd ; and as soon as the dogs either stop, or spring the game they are in pursuit of, the faulconer uncaps his bird, and throws him off his fist into the air, after his prey. 'Tis then extremely entertaining to behold him press forwards, hang hovering in the air, pursue his game, and at last mount upwards, by degrees, and reiterated springs, till the eye has lost him in the middle region. There he has a full prospect of all the plain ; there he observes the various motions of his prey, who, by the distance of its enemy, imagines itself secure from all danger : till at last he stoops down upon it all at once, swift as an arrow from a bow, and conveys it to his master, who recalls him. Upon his return with success, he is always presented with the neck and intestines of the bird he has demolished. These gratifications, together with such other endearments as the faulconer thinks proper, encourages the bird to be more sprightly and active in his employment ; to be regular and observant, and not bear away his bells ; that is to say, not take distaste, and fly away from his master ; which is sometimes the case. But I am very much to blame for expatiating on a diversion, which, no doubt, the Chevalier is as well acquainted with as myself.

Chev. I have seen this diversion, I own, with abundance of pleasure ; but never had a right idea of the method observ'd in the training up these birds for it. I should be glad therefore to know, my Lord, how the gentleman, your neighbour, teaches his faulcons to fly at hares and rabbits, as well as game of the feather'd species.

Count. This is what the sportsmen term, flying a bird at the fur ; and there are some faulcons, that fly at the fur and the plume too ; that is, are taught to fly at the hare, or the rabbit, as well as the pheasant, or any other bird whatever. The task is not hard : When the faulcon is grown very tractable, the master takes a live hare, and breaks one of his legs ; or otherwise procures a hare's skin, and stuffs it with straw : To this he fixes the leg or wing of a chicken, or some other tid-bit, that is most agreeable to the faulcon ; and then, having first fasten'd

one end of a long piece of packthread round the neck of the stuff'd hare, ties the other end of a horse's girth. Thus the stuff'd hare being trail'd swiftly along the ground, the faulcon imagines it to be a hare in flight, and is by that means induced to make a stoop at it: And thus, by a little practice, he becomes familiarly acquainted with the hare.

Nay, the Gentleman before-mentioned has made a further improvement of his method. He has train'd up his faulcons to stoop at a roe-buck, a wild boar, or the most voracious wolf that ever infested the woods: Which is an important service to the whole country round about us, when those dangerous creatures multiply their species. The method he observes is this:

He†accustoms his faulcons, as soon as they are capable of feeding themselves, to eat what is provided for them out of the sockets of a wild boar's eyes, or those of a wolf, or such other wild beast as he thinks most convenient: In order thereto, he preserves the head and skin of the first he kills, and stuffs the latter in such a manner, that it seems to be alive: These faulcons, as I observ'd before, never eat but out of the sockets of some wild beast's eyes. Having proceeded thus far, he begins to drag this inanimate figure gently along the ground, whilst his faulcon is feeding; till, by degrees, the bird is accustomed to fasten himself to it, tho' the carcase be drawn about the field backwards and forwards as fast as a horse can gallop. Were he to quit his hold, he would lose a meal; for which reason, he takes all the care and precaution imaginable to rivet himself on the skull, that he may plunge his beak into the eye, tho' the motion be never so precipitate. After these first essays are over, my neighbour orders the carcass to be thrown into a cart, and the horses to be drove as fast as possible: The bird follows it and feeds all the time. When he is brought into the field, and actually employed in the pursuit of his game, he never fails to stoop down at the first wild beast he sets his eyes on, and in a moment fastens on its head, in order to pick out his eyes: This tortures the creature

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to the last degree ; stops his career, and gives the sportsmen an opportunity to come up, and kill him without any danger, for the beast is too deeply engag'd with the bird to fall foul upon his pursuer.

Chew. Birds thus train'd up, must doubtless be much more serviceable to their masters, than the fiercest dogs.

Prior. I can give you an instance of something still more surprizing ; and there are people in the world, to whom even untam'd eagles † prove highly advantageous. I was intimately acquainted with a person of distinction, who kept a very elegant table, and had no other steward but an eagle ; who constantly furnished his kitchen with the most exquisite dainties.

Chew. 'Tis to be hop'd this notable caterer had a handsome salary.

Prior. If you'll have patience, you shall have a faithful account, both of his services, and the gratifications he received in return for them. I once attended on a young nobleman, who had a great inclination to see the antiquities of *Nismes*, before he went to *Marseilles*. Accordingly we took our rout thro' *St. Flour*, intending to proceed from thence to *Mende*, in the *Gevaudan*, and so across the *Cevennes*. * As he travell'd with a commission from the court, he was receiv'd wherever he came, with all the testimonies of respect imaginable. An officer of distinction in the neighbourhood of *Mende*, invited his Lordship to spend two or three days with him at his country-seat ; and entertain'd him accordingly, in the most elegant manner. At the first collation he made for us, we observ'd with some surprize, that all the wild fowl were dismember'd before they were serv'd up : One was brought without a head, another without a wing, and a third without a leg. Upon which, our officer, in a very agreeable manner, told us, he hop'd we would excuse the voraciousness of his purveyor, who always took the liberty to be his taster before any thing of that kind was brought to table. When we desir'd to know who this extraordinary person was, and when he found we began to animadvert with freedom on the novel method he had introduced, he entertain'd us with the following relation.

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† *Memoirs de la vie de Mr. Aug. de Thou*, lib. iv. pag. 117.
Rail. Synopsis. Method. Avium, pag. 6.

In these mountainous parts, said he, which are more fertile than any others throughout the kingdom, the eagles frequently build their nests in the cavities of such inaccessible rocks, as can scarce be ascended, even by the assistance of ladders and grappling-irons. As soon as our shepherds have discover'd the situation of them, they immediately erect, at the foot of the rock, a small hut, or hovel, in which they secure themselves from the resentment of those destructive birds, when they convey their prey to their young ones. The male and female jointly take care to furnish them with all necessary provisions for three months successively; but when that term is expired, one of the eaglets is turn'd out, and oblig'd to make a trial of his strength: The parents, if they find his wings fail him, and he is in danger of falling, fly on each side of him and bear him up. During all the time that the eaglets continue in the nest, the old ones make prodigious havock all round the country: Capons, chickens, ducks, lambs, kids, and sucking-pigs, are easy victims. In short, whatever falls in their way, is seized upon, and carry'd directly to their nest. But the distant parks and woods supply them with their favourite game; where they find pheasants and partridges in abundance; wood-cocks, wild-ducks, hares, and young swans. The shepherds watch their motions, and as soon as they perceive that the parents have taken their flight, they immediately raise their ladders and climb up the rocks as well as they can, and then carry off the dainties, which those eagles had provided, and leave the entrails of animals, or any other coarse provision in the room. But as 'tis impossible for them to be so expeditious, as to prevent either the eagles or eaglets from devouring some part of their food, the tid-bits, which the shepherds rob them of, must necessarily be mangled, more or less, before they come to hand. However, to compensate for that deficiency, those fragments have a more delicious flavour, than any thing that can be purchased in our publick markets. Our officer added, that when the eaglet is grown strong enough for flight, which is a considerable time first, as he is deprived of his dainties, and obliged to take up with carrion, the shepherds bind him fast down, and confine him to his nest, that his parents may continue to ravage

the fields for his future support. At last, however, the task grows disagreeable to them, and obliges the male first, and then the female, to abandon him. The male, thereupon, looks out for a more commodious situation. The female follows the track of her belov'd partner, and their mutual indulgence and affection for another brood, make them forget the poor disconsolate eaglet under confinement, who is left to perish with hunger, unless some compassionate shepherd thinks fit to release him.

Our officer, after the relation of this fact, assur'd us further, that three or four of these eagles nests were sufficient to furnish out an elegant table all the year round; and that instead of murmuring at the creator of eagles, vultures, and other birds of prey, he thought himself very advantageously posted, and look'd upon every eagle or vulture, that built her nest upon his estate, as a very valuable tenant.

Count. As our discourse turns upon eagles, I must inform you, Doctor, that we have a young one just ready for flight, without further assistance; I mean the Chevalier, who came into my study this morning to peruse my books, and make extracts from them, to compare one author with another, and then make very smart reflections upon them both. We may venture now to trust him alone.

Chev. With submission to your Lordship, I ought rather to be compar'd to one of your *Niaffes*, as you call them, that never saw any thing. I was solicitous, however, to know what became of the swallows, and an infinite number of other birds, which fly about for a season, and then in an instant, as it were, are seen no more. — In order, therefore, to close our present entertainment, in pursuance to her Ladyship's allotment, I'll venture to communicate what I have collected on that subject.

There are some birds of passage, that make choice of the coldest countries; others delight in more temperate climates; and a third species are best pleased to reside in those parts where the sun has the most powerful influences: Some content themselves with passing only from one country to another, to which either the air, or the plenty of provisions, attracts them at some particular seasons:

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Others traverse the ocean, and undertake such long voyages, as one would imagine morally impossible to be perform'd by such little creatures. The birds of this species, which are best known, are quails, swallows, wild-ducks, plovers, woodcocks, and cranes. There are several other species, however, whose respective names, could I recollect them, would be too tedious here to enumerate.

Quails, in the spring, transport themselves from *Africa* into *Europe*, in order to reside, during the summer-season, in a more temperate climate, than that from whence they came. At * the latter end of autumn, they steer their course back again over the *Mediterranean*, that they may enjoy, in *Egypt* and *Barbary*, the same degree of heat, which they obtain'd in those climates they last abandon'd, when the sun was on the other side the equator. These quails take their flight in such numerous troops, that they sometimes appear like thick clouds in the sky; and very often our ships are so covered with them, that the sailors can catch them with all the ease imaginable.

The method observ'd by the swallows is quite different. Some will assert, that they cross the seas; but, by the *English* and *Swedish* accounts of them, 'tis manifest, that several, at least those who reside in the northern countries, continue in *Europe*; and clinging fast with their claws and bills to one another, bury themselves in some dark subterraneous caverns. Whole† multitudes of them resort to places unfrequented by any human creature, and some conceal themselves in the very waters. The care which they take before their retreat, to oil their feathers well, and to roll themselves up in a heap, their heads within, and their backs without, secures them from any harm, whilst in the water, and in hard frosts, under the ice itself. There they lie congeal'd, and pass the long tedious winter, without the least motion or subsistence. Their little hearts, however, have an uninterrupted palpitation; and at the return of spring, the sun's genial heat dissolves their frozen limbs. Thus set again

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* Bellon.

† See the account given to the Royal Society at London, Feb. 12. 1713. *Philos. Trans. and Journal of the Learned.* 1666, to 1667.

at liberty, they revisit their former habitations, and each individual bird finds out its proper country, city, village, and nest.

As to wild ducks and cranes, both the one and the other, at the approach of winter, march off, in quest of milder climates: Both of them, like quails and swallows, assemble on a certain day. They decamp in a body, and 'tis an agreeable amusement to observe the order of their flight. They range themselves, for the generality, in one long column, like the letter I; or in two lines, united in one point like the letter V revers'd. The wild-duck or crane, that forms the point, cuts the air, and facilitates the passage of the rest. However, he is charg'd with this commission but for a short time; at the expiration of which, he falls back into the rear, and another assumes his post. There are several other instances of dexterity and address ascrib'd to them: But his Lordship has caution'd me not to be too credulous in that particular; and by consequence has made me abridge my quotations.

Countess. I have often heard much talk of a species of little men, scarce eighteen inches high, who, as I have been inform'd, wage war with the cranes, upon their first arrival on the coast of the *Red-sea*: If I am not mistaken, they call 'em—*Pigmies*.

Prior. Those little men, madam, are only apes, who stand battle with the cranes in defence of their young, which*those birds, unless oppos'd, would carry off and destroy.

Countess. Altho' I have frequently observ'd, that the swallow annually assemble on a certain day in autumn, in order^s to march off in a body; and altho' I have often seen a flight of these birds of passage on their journey; yet I have always thought the fact very surprising. When I reflect on their progress over seas and kingdoms, I am at a loss to determine which of the two is the most miraculous circumstance; the prodigious force that supports them through such a tedious passage, or the order and discipline observ'd by them in the execution of it. Who inform'd their young that it would be highly requisite to abandon their native land, and travel into a foreign country? What particular bird takes the charge
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upon him, of assembling their grand council, and fixing the day of their departure? Who sounds the trumpet, that informs the whole clan of the resolution taken, in order that each individual bird may be in readiness for the march propos'd? Have they any kalender by which to determine the reason, and the very day of their removal? Have they proper magistrates to preserve that discipline and decorum, which is so strictly observed among them? For, till the proclamation be publish'd not one of them presumes to stir; and yet on the day succeeding that of their departure there's not one straggler, or deserter to be seen. Have they any particular charts * to direct them in their course? Have they any knowledge of what islands lie in their road, where they may rest and refresh themselves? Have they any compass to be their infallible guide to the coast propos'd, without having their measures disconcerted, either by accidental rains, adverse winds, or long, dark, and dismal nights? Or, in a word, are they endued with a degree of reason superior to that of man himself, who would never rashly venture on such a tedious passage, without being first furnish'd with an infinite number of machines, and a sufficient store of proper provisions?

Prior. They have, doubtless, Madam, neither charts, compass, nor reason, but the Almighty is their guide and their protector, and imprints on the minds of each individual bird, a particular method, and such ideas as are suitable to its nature. Were these operations the effect of a reason, that was proper and personal to them; was the Deity to abandon them to their own understanding, that faculty which appears in them so surprizing and extensive, would not always be subservient to one mode of action.

Count. Your observation is, doubtless, just; for had all the individuals of the same species the same principle and rule for their direction as we have, and had each of them, the liberty of thinking after their own manner, they would differ in their sentiments and opinions of things as we do. The swallows in *China* would never build their nests according to the *French* mode; but the *Asiatic*,
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Greek,

* Explic. de l'Ouvr. des 6 jours.

Greek, or *Roman* taste would prevail amongst them : The *Italian* and *English* swallows would look down with pity on the *Chinese* architect ; and even in *France*, the swallows at court would neither build nor live after the manner of those in the country : They would doubtless follow the mode, and communicate it to the rest ; but when once the nation had prevail'd of establishing another, the former would be despis'd as a ridiculous, and *Gothic* building. Were swallows, in short, endued with reason, there would be a subordination, or dependance one upon another. The most sagacious, and enterprising part of them would, without doubt, acquire the highest posts ; and, by necessary consequence, the swallows of distinction would not herd with the populace, but leave the labouring oar to them. To chirp with greater delicacy than the rest, would be deem'd an affair of importance among them. They would refine on the adjustment of their feathers and their genteel deportment ; they would assume a fine air, and a new fashion would always find more admirers than an old one. In short, had swallows but the faculty of reason, they would be for ever inventing, reforming, and bringing matters nearer to perfection every day ; they would then do, like us, a thousand rational and important things, of which at present they have not the least idea.

Countess. You have very just reason for rallying the follies and foibles of the generality of mankind. The actions of beasts are so simple and regular, that any one would imagine, that they were endued with reason ; whereas ours are oftentimes so very capricious and imprudent, that no one would think we had any reason at all. But we deviate from our subject. Pray, *Gentlemen*, let us return to the inhabitants of the air. Are there any not yet discours'd of, that deserve a particular attention.

Prior. None, Madam, as I can think of, but the various species of night-birds : All † the others, of what denomination soever, sing their matins before the rising of the sun, and perform their vespers, by way of homage, after he is set. However, amidst this general approbation of the light, these birds of darkness alone profess

their utmost detestation and abhorrence of it. They avoid it, as their most implacable enemy; they will never suffer it to be an eye-witness of their actions; and whilst it cheers and enlightens all nature besides, they hide themselves in the most gloomy caverns. They wait with impatience for the return of darkness, that they may steal out of their lonesome prisons, in which the hated daylight had confin'd them; and then, they testify their joy by the most hideous screams. Tho' all of them have a cry peculiar to their respective species, yet all of them in general are disagreeable and shocking to the ear. Their very form has something in it very wild, frightful, solemn, and gloomy; and one may discern an irreconcilable aversion to man, and every other living creature, in their very features. The generality of them have crooked bills, and sharp talons, out of which their prey, once seized, can never escape: Those hours of darkness, which were design'd for slumber, and the refreshment of nature, are employ'd by them in surprizing other birds that are unguarded, and asleep. 'Tis with difficulty, that the most vigorous avoid them; but the weakest are their certain prey. They add likewise surprise to cruelty, and artifice to rage; and after they have been vigilant for the public calamity, they retire, before the rising of the sun, to their dark solitary abodes. They prefer, for the generality, old castles, and uninhabited buildings, to all other recesses whatsoever, as if desolation and melancholy ruins, which denote the neglect of the owners, or the subversion of families, were capable of inspiring these ill-omen'd birds with sentiments of joy.

'Tis impossible, in the collection of all these particulars, not to discern a lively representation of those malicious fiends of darkness, who are put to flight by the restless charms of truth; who take delight in every thing that may possibly cast the least cloud or shadow over it; who take the advantage of the unguarded hours of indolence and sleep, to devour such souls as they detain in chains of iron, when they have once got possession of them, whose misfortunes and losses are their principal support; and who reside no where with so much satisfaction and delight, as in the hearts of those who are obstinate, perverse, and irrecoverably lost. The

sacred scriptures warrant this parallel between those infernal spirits and the birds of darkness, and confirm us in the belief of that Deity, whose Wisdom and Understanding are infinite, has filled the display and order of nature with proper lessons of instruction for our spiritual improvement, and the salvation of our souls. *Babylon*, says the sacred penman *, *is become the habitation of devils, and the hold of every foul spirit, and a cage of every unclean and hateful bird.*

As these birds of night are implacable enemies to every other species, so they, on the other hand, are equally the objects of abhorrence and detestation; inso-much that, as soon as either the little owl, the great owl, the horn-owl, the osprey, or any other night-bird whatever, is detected, either through want of sufficient precaution in the concealment of its habitation, or its hideous and abominable hooting, there is an universal combination against the odious, ill-omen'd creature. Both small and great flock round about him, and load him in their way with the heaviest reproaches; but it seldom happens that he is attack'd with that impunity as he is insulted. The fowlers take their advantage of this avow'd and publick aversion, and spread their nets, for such as rashly venture out, at the real or fictitious scream of one of these profess'd enemies of the whole feather'd race: For after they have erected a hut, contiguous to some wood, and cover'd it all over with green boughs, they fix lime-trees all round the hut, on which the birds of various kinds alight and perch, the better to insult their common foe, whose baneful cries have rous'd up their resentment; and when they fail with the lime-twigs, which are but slightly fix'd, they besmear and embarrass their wings in the glew, and lose both liberty and life in the hands of those fowlers, who wait to observe their fall, and take the advantage of their indiscretion.

Countess. This little rural exercise is very entertaining. *Chevalier*, I presume you are no stranger to it.

Cher.

* Revel. xviii. 2.

Chev. I know, Madam, indeed, that 'tis called the Decoy, and I have heard much talk of it; but 'tis a diversion I never saw as yet.

Countess. His Lordship then will soon shew you the nature of it.

Count. To-morrow morning, if you please, Sir.—
But are you an early riser?

Chev. I'll undertake to wake the whole family.

Count. Let's go on, and give the servant directions accordingly.

Chev. It shall be my business to collect all the cages that can be found within a mile of us.

Count. We'll furnish you, Sir, with all necessary material, without borrowing of our neighbours; and I'll answer for it, Chevalier, that you shall always have more cages than birds.

Terrestrial Animals.

DIALOGUE XII.

The Count and Countess, the Prior, and the Chevalier.

Countess. **N**OW, Chevalier, be ingenuous, and answer me one question without reserve. Should I propose to you a philosophical lecture, or the repetition of your yesterday's diversion, which would be most agreeable to you?

Chev. I would instantly order the lime twigs, Madam, to be got ready.

Countess. That's free now, and without disguise. As the decoy, however, can seldom be repeated, because the

birds are very shy, and abandon the place where the net has been once spread, and then you must build a new hut. I promise, in lieu of it, if you love angling, to furnish you with proper materials, as often as you please, which will be equally entertaining. In the mean time, let us reserve the large beasts for the chase, and turn our conversation upon *Terrestrial Animals*. But here are our company.—Gentlemen, if my regulation of the subjects of our former conversations was no ways disagreeable to you, I beg the favour of your indulgence once more. Should I let you chuse, 'tis probable, you would convey me into a country of which I have no map, and to which I am a perfect Stranger. As we have treated already on insects and birds, the transition will not be unnatural, if we proceed to the sheep, the goat, the cow, and such other creatures as are familiar to us. For my part, I shall confine myself to them. You, Gentlemen, if you please, may make choice of such as are more uncommon, and are brought to us, as curiosities only, from the most distant parts.

Count. Even those, Madam, which are daily obvious to our view, deserve our most serious attention. We need not ramble round the globe for proper objects of our admiration.

Countess. I beg of you, Gentlemen, that you would make choice of *Asia* and *Africa* for yourselves; nay, you may take in *America* likewise, if you think proper. In my opinion, there's enough in conscience to give you satisfaction. Should you take from me the common animals, you would deprive me of my quota. Your president would have nothing to say.

Prior. The subject which your Ladyship has made choice of is very copious, and not easily to be exhausted. Domestic animals would furnish us with matter sufficient for twenty entertainments. We'll appoint the Chevalier, if he pleases, to open the conference. By his giving an immediate and unpremeditated answer to one single question, he'll be convinced of one of the most beautiful instances of the Almighty's goodness to mankind that ever was produced. Were we to traverse the woods in quest of a considerable number of young wolves, bears cubs, and lions whelps, would it be possible, Sir,

do you think, to make them tractable, to divide them into three distinct classes, according to their species, and rear them, as we do a flock of sheep, in our meadows?

Chev. It would, in my opinion, Sir, be absolutely impossible. We might, indeed, train them up, and abate something of their fierceness; but as they are by nature of a surly, savage, and vicious inclination, we could never be able to keep them long under any subjection, much less have the command of them in droves.—We had some time ago two young wolves rear'd up at our house, that at first seem'd tractable enough, and no ways mischievous: But they soon gave us a sufficient proof of their savage dispositions. The two unlucky whelps one morning thought proper, upon some slight provocation, to fall foul on one of our hounds, and tore him limb from limb: After that, they dispatch'd three kids, and then brush'd off to the woods.

Prior. You have hitherto imagined, Chevalier, that this association of a large herd of cattle, or flock of sheep, under the guidance of one shepherd, or the inspection only of his boy, was the pure result of man's industry and application; but tell me ingenuously what you think now, upon more mature deliberation.

Chev. I am very sensible, that this union and agreement is owing to the Deity alone, and is one of the most valuable presents he could possibly bestow upon us.

Prior. Supposing we could succeed so far, as to make lions and bears social creatures, we should never be able either to make them work, or carry burdens for us. But granting even this to be practicable, would they be long contented with the grafs of the field?—Nature is not to be changed by education:—And were their depraved and voracious appetites to be indulged, instead of being advantageous, or any ways assistant, they would prove destructive to their owners: Whereas, on the other hand, most domestick animals work hard, and are maintained at a very reasonable expence: They chuse rather to reside with, and be in subject to man, than to enjoy sweet liberty itself, and live without controul: They are endued with a large share of strength, and employ it all in his service: They own him as their lord and master, and execute, without the least reluctance, all his

his commands. Now, what recompence do they expect for all their services? Why, nothing more than a little grass, and that of the driest sort, and the least valuable part of all his grain. They have no taste for any delicious food; but reject it with as much abhorrence as they would the most malignant poison. Are these abstemious inclinations, which are so advantageous to us, the result of our care and industry? No, most certainly; and the Chevalier has with justice called them one of the Deity's most valuable presents.

Countess. He must be blind, or ungrateful to the last degree, that offers to deny this apparent truth: For these animals are not only tractable, but love is implanted in their very natures. They tender us their respective services of their own accord, and never perform them with the least reluctance: Whereas those whom Providence has not assign'd for our assistance, think it sufficient that they do us no harm, unless we provoke them, and withdraw into woods and desarts, as a testimony of their respect to us, and their voluntary resignation of every other part of the earth to our use.

Chew. The benevolent dispositions which are implanted in domestick animals, are, doubtless, visible marks of a Divine Providence: But how shall we reconcile the voracious appetites of wild beasts with the goodness of the Supreme Being? Does a wolf, who worries a whole flock of sheep, seem a proper object to do homage to the Great Author of nature?

Prior. He, doubtless, does homage to the Deity in his own way; inasmuch as he answers the wise purposes for which he was created. Some animals are pre-ordained by Providence to live with, and be serviceable to mankind; others to reside in woods and desarts, to animate all nature, and prove a scourge to all such of the human species as grow profligate and abandon'd wretches. The same providence is conspicuous in that tractable temper which is implanted in those animals, whose whole lives are devoted to our service: And is the attention of that Over-ruling Power less apparent in the preservation of all those wild beasts, whom it sustains in rocks and unfrequented desarts, without any commodious habitation, proveditors, magazines, or the least assistance,

tance, in short, from any human creature whatsoever or rather, notwithstanding all the united efforts of mankind to oppose and destroy them? and who, nevertheless, have a greater affluence of all things, are more active for the chase, much stronger, better fed, more gay and sprightly, better clothed, and more beautifully formed, than most of those animals, who have men for their purveyors.

Countess. You see, Chevalier, that the hand of Providence is visible in all its works, and rather claims the tribute of our adoration, than our censures on such matters as are above our comprehension.—But I beg of you, Gentlemen, to return to our domestic animals, and let our conversation turn on such topicks as are within the reach of my weak capacity. Let the Count, for instance, give us an encomium of his horse, and the Chevalier expatiate on the perfections of his dog: For my own part, since I pretend to some œconomy and skill in the management of a dairy, I declare for the cattle: As for the rest, the Prior is at free liberty to treat of them in such manner as he sees most convenient.

Count. I am perfectly well pleased with my allotment.—If custom had not dignify'd the lion with the awful title of *King of Beasts*, reason, in my opinion, would bestow it upon the horse. The former, in reality, has no manner of right to it: He is rather an usurper, and a tyrant; for he makes no other use of his prerogative, than either to devour his subjects, or inspire them with horror and amazement. The horse, on the other hand, neither injures his fellow-creatures in their persons, nor attempts to invade their properties: He does nothing to render himself the object of hatred or contempt: No bad qualities can be justly ascribed to him; and, in fact, he is possess'd of all such as are amiable and praise-worthy. There is no animal whatever so complete, with respect to the symmetry and proportion of his parts; has a more generous spirit; is more liberal of his services, and more abstemious in his diet. Cast your eyes on all other animals, of what species soever, do you find one that has so beautiful a head, or eyes so sparkling, and full of fire? One, whose neck is clothed with equal thunder, and whose mane waves in the wind with so much

much grandeur? One, in short, who has a more stately chest, a finer body, or more curious limbs? Whether he be under the direction of his rider, or at his own liberty to range the fields without controul, you'll observe, in all his attitudes, a noble deportment, and an air which strikes the eye of every beholder, tho' insensible of all his other perfections, with an agreeable surprise.

His inclinations are still more engaging: He can properly be said to have but one; and that is, to be as serviceable as possible to his master: If 'tis expected he should drag the plough, or carry any burden, how heavy, soever, he is always ready and willing, and would sooner sink under the weight, than decline it, or complain. Does the owner propose to ride him, he seems conscious of the honour; uses his utmost endeavours to please him; at the least signal alters his pace, and either walks, trots, or gallops, as required: Neither the length of his journey, the badness of the road; neither hedges, nor ditches, nor even the most rapid rivers, discourage him; he flies like a bird over every obstacle that would give a check to his career. Is there any farther service expected from him?—Is it incumbent on him to defend his master, or bear him to an engagement? He goeth on to meet the armed men; he mocketh at fear, and is not afraid: The sound of the trumpet and the drum inspire him with fresh ardour, and he turneth not back from the sword.

Countess. This is a perfect panegyrick, my Lord.—Pray, when may we have room to cough?

Count. I had a thousand articles more to add in his favour. I thought to have expatiated on his curvettings, his caracols, or various wheelings, and all his other majestic airs; but since you rally me for this first part of his encomium, which was unpremeditated, and clothed in the style of a soldier, you must excuse me, if I proceed no farther.—Now, Chevalier, let us hear what you have to offer in behalf of your dog.

Chev. I wish we had him here: He'd entertain you much better than I can, by giving you a description of him. He is the king of shocks, and his name is *Mastiff*. There is not a better shap'd spaniel in all France: He

has a glorious coat, a pair of fine long ears, large whiskers, and a ruff about his neck, as white as snow: In short, he is not only possess'd of all the external good qualities that can be named, but he is well broke, can boast as liberal an education as any dog in the kingdom, and performs all his exercises with an inimitable grace. He can hunt, dance, skip, and play a vast variety of little pretty gambols. Among many more, he'll bring any particular card out of a whole pack that you shall name, without making the least mistake.

Countess. He must have his confederates then. But all raillery apart, those animals seem at least to have a degree of reason.

Chew. They have indisputably, Madam, a very tenacious memory. A dog is taught at first to distinguish one thing from another by some particular mark, and after that to know an ace of *Clubs* from an ace of *Hearts*. 'Tis customary to give him victuals upon a card that he never saw, and afterwards to send him to pick it out from among others; and he very seldom, if ever, makes a mistake. The habit of receiving a gratuity, as well as caresses from his master, enables him, in process of time, to know every card distinctly, and to bring that which is called for with an air of gaiety, and without the least confusion. And, in reality, 'tis no more surprising to see a dog distinguish one card from thirty others, than 'tis to see him find out his master's door from any of his neighbours. But what principally diverts me, is his artful manner of address, and his little subtle devices. If I take my books, in order to go to college, my poor dog, who knows I shall be gone for three or four hours, puts on a gloomy discontented aspect, as if he had met with some deplorable disaster. He plants himself at my chamber-door, and never stirs till he sees me again. But if, instead of my books, I take my hat and cane, or only say, *abroad!* he proclaims his good fortune all over the house, flies backwards and forwards, up stairs and down, and barks to that degree, that 'tis impossible for any one, who sees him, to forbear laughing. If he finds I am dilatory, he grows jealous that I have some design to leave him behind me: For which reason he marches off, by way of

of prevention, and waits for me, at the first turning he comes to, in hopes to make one of the party. If I tell him he must go home, he expostulates with me, and uses all the rhetorick he can think of to prevail on me to revoke my orders. When he finds I am resolute, and check him with a frown, the pitiful air he puts on is almost inexpressible. If I say, *Let us be gone*, Musti! he testifies all the instances of gratitude that can possibly be conceived. But when I happen to be absent from home, for two or three days together, the salutation, at my return, is still more hearty and ardent. He looks upon it as a compliment paid to himself: He is perfectly transported, and an hour or two will sometimes be insufficient for him to express the overflowings of his heart.

His friendship, however, does not terminate even there: He seems to watch over me night and day, for my preservation: He knows every individual thing that occurs, and gives me immediate intimation accordingly: He is ready to fly at every stranger that approaches me; but waits first for my orders: He reads his own behaviour in my eyes; and should any one presume to attack me, a drawn sword would not oblige him to retreat. Some months ago, when I first learnt to fence, *Musti* was with me; and finding my master push at me, he seiz'd him by the leg: And ever since there has been such a bad understanding between them, that I am forced to part them.

Count. Of all the accomplishments which a dog is capable of attaining, there is not, doubtless, any one half so valuable as that inviolable friendship and undaunted courage which he shews for his master on all occasions: And 'tis very plain, that the Deity consigned the dog to man, to serve him as a faithful companion, assistant, and protector. The services we receive from dogs are, in short, as various as their species.

The mastiff and the bull-dog guard our houses in the night, and reserve all their fury and resentment for that season wherein necessitous vagrants may form their villainous designs against us. The shepherd's dog is qualified to attack the wolf, when he worries his sheep, and to regulate the flock. Among the various classes of sporting-

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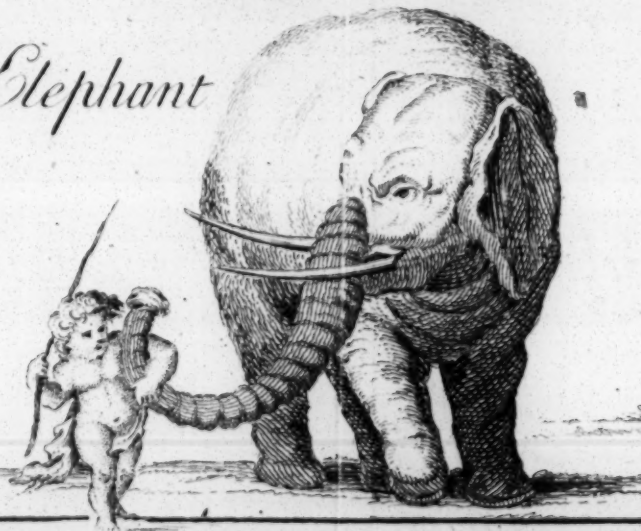
Beaver



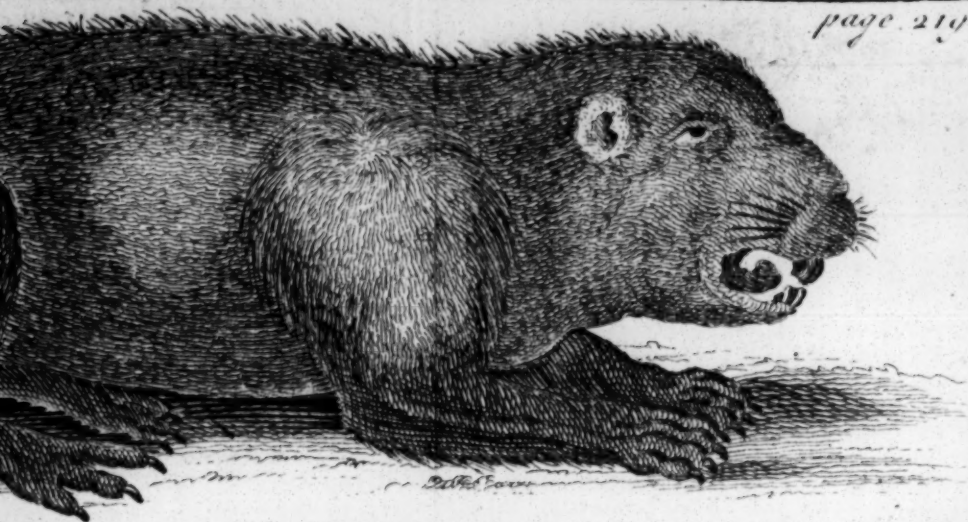
Porcupine



tame Elephant



B. Cole, Sculp.



Hedghog



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sporting-dogs, the terrier has very short legs, to enable him to bury himself in the grass, or break his way through a quick-set hedge. Nature has bestow'd on the greyhound a sharp head, and a slender body, in order to cut the air with more ease, and pursue his game with greater expedition: His long thin legs soon stretch over a large tract of ground: He exceeds even the hare in point of swiftness, whose safety therefore principally depends on her doublings and turnings, and other arts of flight. This creature is the reverse of the terrier, not only in his structure, but his daily exercise and employment. The latter is short-sighted; but then he has a fine nose, because he has more occasion for a sure scent than a quick eye, when he lies concealed in the grass, or darts through a bramble-bush. The greyhound, on the contrary, is of little service but in the plain, and has no scent: He never fails, however, of discerning his prey at a distance, and putting off her changes. The setting-dog stops in a moment, and squats as soon as he spies his game, in order to give his master timely notice. There are divers species of them, whose names vary according to their respective qualifications: All of them, however, are equally eager for the sport, and faithful in the due discharge of their several functions. The sportsman, tho' seldom over pleased with his companions, as being irregular in the pursuit of their sport, is charmed, however, with the capacity and understanding of his dogs. At the close of the chace, and after the transient pleasure of partaking of the carnage, which is their fee, tho' not always given them, they all return to the kennel and the halter; that moment they forget their fierceness, gayly resign their liberty, and, without the least murmur or expostulation, make a hearty meal of the coarsest food that is set before them. 'Tis sufficient that they have contributed towards their master's diversion, and furnish'd his table with an elegant entertainment.

In short, amongst all these various domestick animals, who are so tractable, and so inviolably attach'd to their owner's interest, there is not one, even down to the spaniel and the *Dane*, but what renders himself amiable by his sprightliness and activity, valuable by his indefatiga-
ble

ble industry, and sometimes serviceable by his vigilance and the timely notice he gives his master of some approaching danger in the night, when all the family perhaps are a-bed and fast asleep. The horse and the dog, in short, are the only two animals on whose friendship and fidelity we can with safety depend; for which reason the old proverb says, that *a man, a horse, and a dog, are never weary of each others company.*

Countess. Tho' it must be allow'd, that both the horse and the dog have excellent good qualities, and afford us a constant and an agreeable amusement, yet there are things more absolutely necessary for us, such as food and raiment; and for these invaluable presents we stand indebted to the cattle. The flesh of these animals is so succulent, substantial, and perfect, that we abandon the most exquisite dainties to return to them, and are never cloy'd with the refreshment they afford us. How do they employ their time, whilst we permit them to live amongst us? 'Tis plain, the cow, the goat, and the sheep, were consigned to us by Providence for the increase of our substance. We furnish them with a few herbs, and suffer them to range all day at liberty round the fields, to regale themselves on what they can find, and what is of but little or no service to us; and they return home in the evening, to repay the obligation, with large over-flowing bowls of milk and cream. No sooner is the night pass'd, but they earn the sustenance of the ensuing day, by a repetition of their favours. The cow alone supplies the poor with what they value next to bread, and crowns the tables of the rich with a variety of dainties: The sheep, well satisfied with being clothed in the winter, freely resigns his fleece to us in the summer. In fine, we are indebted not only to the animals before-mention'd, but those too, whom we always look upon with an eye of contempt, for a hundred other conveniencies, which we can never receive from such as are untractable, and study to avoid us. When a wild beast approaches us, 'tis with an evil intent, either to rob or destroy us; whereas, on the other hand, our domestick animals come home to us with no other view, but to oblige us with their presents. If there is any thing that depreciates their favours, 'tis the frequent

frequent repetition of them. The ease with which we procure them, makes us either forget, or undervalue them; tho', in reality, it ought to enhance their merit. A liberality which meets with no interruption, but is daily repeated, deserves, doubtless, to be as daily acknowledged; and the least we can do, when we receive a donation, is to give thanks to our benefactor.

These animals are for ever before our eyes; and I can every day discern in their conduct new foot-steps of an All-wise and Over-ruling Providence. When I reflect upon the dam, I observe an excessive fondness and indulgence in her towards her young: Tho' they have no knowledge of any thing, and are incapable of action, yet the affectionate regard of the parent for them makes ample amends; and all their necessities are instantly supplied. When I cast my eyes upon her young, they are new objects of admiration, through all the variety of their progress: They can find the teat, even before they can see; and, without the knowledge that any pressure of it is necessary, they employ their fore-paws by turns, after a very dextrous manner, and thereby express the liquid that sustains them. When the parent and her brood are parted for any time, they hunt after each other, with all the care and concern imaginable; and when they are within hearing, they give mutual notice, by such signals as all of them understand. The dam can distinguish the cry of her own offspring from that of a thousand lambs; and the latter knows her mother's bleat from that of a thousand sheep. The drover himself, indeed, frequently mistakes; but the dam and her young ones are never deceived, and a joyful re-union soon succeeds the reciprocal notice which they give of their arrival.

When the lambkin becomes strong, and capable of seeking his own provision, it is highly requisite that the dam should be released from her parental charge; for which reason, she drives him from her, and even treats him with rigour, in case he persists in following her any longer: And the indulgence of the one, is of no longer duration than the necessities of the other. When he has thus lost his milk, he is oblig'd to habituate himself to a coarser diet. He learns to nibble the grass, and

and chew the cud all night, upon what he had reserved in the day. By degrees he learns to distinguish the seasons. In the long summer-days, he rests and chews the cud too; because he may do both without any inconvenience. But in winter, when the days are short, he has no time to lose: He makes as quick dispatch as possible, for fear of a deficiency; and compleats the digestion, by re-chewing in the night, at his leisure, what he had eaten the preceding day.

There are a thousand observations more, that might be made on these domestick animals; but I long, methinks, to hear what the Prior has reserved for us.

Prior. The animal, whose eulogium I propose to undertake, is possess'd of several good qualities, which are very particular. He does not find employment, indeed, in all places; but his services to mankind are very extensive and advantageous. There is not a more laborious, indefatigable, patient, and abstemious creature in the whole universe. Perhaps you may imagine, that I intend to give you a panegyrick on the elephant, who by a little pains and practice may be taught to obey a child; and who at the same time is so strong, that he bears towers on his back, filled with men prepared for battle, without being any ways startled or dismayed at the havoc which they make. Or you may fancy perhaps, that I shall give you a description of the camel, who is so serviceable a creature in long journies, and able to carry a burden of a thousand pound weight; who traverses the desarts all day without drinking; and upon his first arrival at the inn, where his master lets up, bends his knees in the most courteous manner, and stoops to the very ground, that those to whom he belongs may take off his burden with the greater ease. These animals, indeed, have their merit; but that which I propose to make the subject of my present discourse, is still more useful, and more universally employ'd.

Chev. Mayn't we be acquainted, Doctor, with his name?

Prior. If you must know, Sir, 'tis the *Ass*.

Chev. You have made a notable choice, Sir, truly!

Countess.

Countess. Could you pitch, Sir, upon no other animal but this ? Why didn't you introduce the cat ? She is a very serviceable domestick : She is entertaining enough in her play : You would have a hundred things to say, and as many applications to make on her hypocritical looks ; her paws, which tho' soft as down, are arm'd with destructive talons ; her subtle devices, her various turnings and windings, and a thousand other fallacious gesticulations. There had been subject-matter enough to exercise your style.

Prior. As all the world abandons the afs, I am determined to do him justice, and take him under my protection. When I consider this animal in an impartial light, I am highly pleased with him. And I doubt not but I shall make it appear, that far from wanting any indulgence, or apology to be made for him, he may be the subject of a reasonable eulogium.

Tho' the qualities of the afs are not very shining, yet they are solid : If we make our applications to other animals for distinguish'd services, this furnishes us with such, at least, as are most necessary. 'Tis readily granted, that his voice is not perfectly harmonious ; neither is his air over graceful or majestick, nor his deportment very courtly : But then a fine voice, to such people as are seriously inclin'd, is an affair of very little importance. To compensate, however, for these little deficiencies, he has a very sweet and modest countenance ; and instead of those turbulent and irregular qualities of the horse, which as often prove incommodious as agreeable, the deportment of the afs is perfectly natural, without the least affection. He never bridles up his head, or puts on any haughty supercilious airs. He marches with a very regular and uniform pace ; and tho' he is none of the swiftest, he pursues his journey for a long time, without either resting or refreshment. He accomplishes his master's work, without the least noise ; serves him with unwearied diligence ; and what, doubtless, is a very considerable article in a domestick, never boasts of his own performances. His food requires no preparation ; a thistle serves his turn. He insists upon no dues, and never appears dainty or discontented, but is thankful for the least favours. He has an excellent
taste

taste for the greatest delicacies, and yet is courteously contented with the coarsest fare. In case he happens to be forgotten, and is fastened at too great a distance from his fodder, he begs of his masters with all the submission imaginable, and in the most moving language he can think of, to supply his necessities. 'Tis highly reasonable he should live, and all his rhetorick is employed with that view : When he has used all the arguments that he imagines may prevail, he waits with patience for the arrival of a little bran, or a bunch of dry leaves. As soon as he has snapp'd up his hasty meal, he returns to his labour, and marches along without the least murmur or reply ; and these are, doubtless, very commendable qualifications. Let us, in the next place, consider the manner in which he is employ'd.

His daily occupations have some savour, 'tis true, of the abject state of those who employ him : The judgments, however, that are form'd both of the ass and his owner, are partial and unjust. The dignified employments of a judge, a magistrate, or a collector of his majesty's revenues, carry an air of importance along with them. Their advantage of dress is a perfect delusion : On the other hand, the employment of the husbandman has a mean and despicable appearance, because his dress and his condition are equally the objects of contempt : But, in fact, we put a wrong construction upon things. The labours of the latter are most valuable, and alone truly necessary. If the officer of the revenue glitters from head to foot with gold, his outside show is nothing to us ; we reap no benefit or advantage from his labours. Judges, indeed, and magistrates, are persons of some consequence ; but then 'tis through our folly and ill conduct that they become so : Did we but behave ourselves with prudence and discretion, we should want none of their assistance : Whereas, on the contrary, we could never subsist long without the husbandman and the mechanick, upon any account, or in any season or state of life whatsoever. The latter are, as it were, the soul and sinew of the commonwealth, and our principal support. 'Tis to them we are indebted for the constant supply of all our necessities. Our habitations, our dress, our equipage, nay our daily sustenance,

are the result of their labours. Now what difficulties and straits would your vine-dressers, gardeners, masons, and the generality of your poor country people, that is to say, two thirds of all mankind, be drove to, were they destitute of either labouring men, or beasts, for the conveyances of such commodities and materials as they work up, and vend about the country? The ass is always at their service. He carries fruits, herbs, leather, coal, wood, bricks, tiles, mortar, lime, straw, and ordure itself. The most abject offices fall to his lot. 'Tis a peculiar advantage to numbers of mechanicks, as well as to ourselves, to find an animal so tractable, strong, and indefatigable; who, without any self sufficient airs, or any extraordinary expence, furnishes both town and country with all kinds of commodities. A short comparison will give you a perfect idea of the benefits and advantages arising from this poor creature's labours, and raise them from their present obscurity.

The horse bears a very near resemblance to those nations, who are fond of pomp and noise; who are eternally frisking and dancing about; who make dress their peculiar study, and are ever gay. In some distinguish'd and decisive occasions, indeed, they are much to be commended; but their fire too often evaporates into smoke. They run into extreams, exhaust themselves, and lose the most favourable opportunities for want of deliberation and good conduct.

The ass, on the other hand, may aptly be liken'd to those nations, who are by nature heavy and pacifick, who have a tolerable idea of agriculture and trade, but nothing else; who go on in one and the same beaten track, without distraction, and, with an air of gravity and assurance, accomplish whatever they undertake.

Cou tests. Would not any one be tempted to think the Prior's observations just, and that he spoke his real sentiments?

Count. There is, doubtless, something more than gallery in his eulogium; but 'tis indecent, and unsufferable to make an academical harangue, in the praise of so stup'd an animal: 'Tis an affront upon us, who are his audience; and in case any one will second the motion, I insist that the Prior has not furnish'd his contin-

gent, and, by consequence, is obliged to make us some valuable compensation.

Cher. The Prior stands a fair chance to begin once more. For my part, I will not absolutely insist on his making a new oration; but I could heartily wish he would.

Countess. I join my authority, as president, to the opinion of the company, that the Prior ought to make us some restitution. If he should not think convenient to chuse a domestic animal for his subject, he shall have recourse to any savage creature that he pleases.

Prior. Such as make laws, have the privilege of interpreting them. Will your Ladyship therefore permit me to take some foreign animal under my protection.

Countess. You may command the four parts of the world. But, good Sir, favour me one moment. Can you give us any account of an animal, whose name I have quite forgot, that has the character of being an inimitable architect?

Prior. I cannot think of any animal at present, that builds with more art and elegance, than the field-mouse, whose subterraneous cells have a free communication one with another. Each is appropriated to some peculiar use. One is set apart for the reception of her stores, which consist of all sorts of fruits, according to the season, but particularly nuts and ears of corn. These are laid up in heaps, and will keep longer than any article of her provisions besides. Others are appropriated to the service of the family, and furnish'd with beds of wool, and cows-hair. At the extremity of the lodgment, there is one general magazine, that supplies the whole, in the most elegant manner, with all sorts of accommodations.

Countess. I am pleas'd, I confess, with this account of the field-mouse; but that was'nt the animal, Doctor, that I meant.

Prior. Perhaps your Ladyship meant the porcupine or the hedge-hog, who have their respective magazines, and between whom there is a perfect resemblance.

This animal is covered all over with large pointed quills; some white, and some black. When he is attack'd, he bends his head and paws under him, rolls himself

himself up in a globular form, and erects his prickles of quills, in such a manner, that dogs, and other animals, are oblig'd to decline the combat. Such, however, as are resolute, and persist in the assault, most commonly feel the weight of his resentment: For his pointed quills fly off, wound them at a distance, stick fast in their skins, and the more they stir, plunge deeper and deeper; for the point of them being form'd like a screw, every motion of the animal that is wounded, rather fixes than helps to draw them out. Just as when we were children, we have often amused our friends in the fields, by putting an ear of corn under their sleeves, with the beards downwards, promising that by the time they returned home they should find it in their necks. Which juvenile frolick would always meet with success; because all those little points with which the ear is bearded, being deposited as above-mentioned, prevent the ear from descending: And, on the other hand, the motions of the arms in walking force it upwards, by insensible degrees, to the part proposed.

The hedge-hog makes another advantage of his pointed quills. He rolls himself over apples, grapes, or any other fruits he can find, under the trees, and conveys them away in the best manner he can. He eats what takes up too great part of his store-room as soon as possible, and makes a reserve of nuts to serve him till the close of the summer. As to the winter, he makes no provision for it, as he indulges himself in sleep during the best part of that uncomfortable season.

Countess. This animal, I own, has its merits too; but is not still the thing I mean. Our merchant of *St. Malo*, if you remember, gave us a very agreeable description, not long ago, of a creature that is an architect from its birth. Pray, Sir, recollect the name of it, if possible.

Prior. Your Ladyship, I find, means the beaver.

Countess. The very same. Pray favour us with a detail of it.

Prior. An account of it from yourself, Madam, would be much more agreeable and entertaining.

Countess. Very well, truly! What sort of conscience, Doctor, do you act by? First you contract a debt, and then desire another person to pay it.

Prior. Your will is a law, Madam: I find I must comply. To the point in hand then.

There are two particulars to be consider'd with respect to the beaver; one is, the use that is generally made of his skin; and the other, his peculiar art and address in the structure of his lodgment.

This animal is about three or four foot long, and twelve or fifteen inches broad. His skin, in the northern parts, is for the most part, of a dark or blackish hue; but inclines to a red, in more temperate climates. He is invested with two sorts of hair; one is long, the other, a soft down: The latter is extremely fine, about an inch in length, well compacted, and serves to keep the creature warm. The former preserves its down from all dirt, or other moisture whatsoever.

The beaver, whether male or female, has four bags under its intestines, replenish'd with a resinous and liquid substance, which afterwards settles to a thick consistence. Physicians call it *Cestoreum*, and make use of it as an antidote against poisons; and sometimes prescribe it to persons afflicted with the vapours, and other malignant distempers; but 'tis apt to spoil, and grow black, when kept too long, and then degenerates to a dangerous poison.

The long hair of the beaver is stripp'd from his skin, and the down was formerly manufactured, or work'd up into socks, hose, and caps, and sometimes into stuffs: But as these have been found to harden like felt, they are not made use of in several places; so that at present this down is work'd up in nothing but hats and furs. There is one circumstance, that, tho' almost incredible is notwithstanding indisputably true, and that is, those beavers skins are most valuable that have been lain upon longest by the savage natives of the country. By their wearing them, the long hairs fall off, and the down being well compacted, and made moist by transpiration, is better prepared for milling.——But as I see the Chevalier is impatient till I come to treat of this creature's habitation, I'll keep him no longer in suspense.

Chev.

Cher. Proceed, then, Sir, if you please, in the same manner as you did with the bees, and let me know, in the first place, the several implements which he makes use of in the erection of his lodgment.

Prior. He makes use of three, Sir; his teeth, his paws, and his tail. His teeth are very strong. With these he cuts not only the wood with which he builds his lodge, but that too, which is his principal sustenance and support. His fore feet are like those of such other animals as take delight in nibbling their food, and hold it in their paws, as monkeys, rats, and squirrels do. He makes use likewise of his fore-feet in the first place to dig, to scratch up the ground, and then to soften and plash, or mould his clay, which is of singular service to him. His hind feet are supplied with membranes, or large films between his toes, like those of ducks, swans, and all other water-fowl. From whence 'tis evident, that the great Author of nature appointed this creature to live, as well in the water, as on the land. His tail is long, somewhat flat, and covered all over with scales accommodated with muscles, and always duly liquor'd with oil and fat. This animal, who is from his birth an architect, makes use of his tail, as a trough, or hod, to convey away his mortar, or clay; and afterwards as a trowel, to perform the plaistering. His scales prevent these materials from doing any injury to his tail, by means of their coldness, or their moisture: And that profusion of oil which he diffuses all over his skin with his snout, is evidently of singular service in the preservation of his body from any ill effects arising from the water.

These beavers are social creatures, and a whole body of them will sometimes reside together under one roof, unless some violent heats, sudden inundations, the pursuits of huntsmen, or want of necessary provisions, or a too great increase of their family, oblige them to disperse. In order to erect a commodious dwelling-place for their reception, they make choice of some spot of ground that is well stored with provisions, and washed by some gentle stream, that they may be enabled to form a basin, or reservoir of water, proper for their bagnio. Their first care is to erect a mole or dike, wherein the

water may rise to a level with the first story of their intended habitation.

Chev. The first story !——Have they, Sir, like us, a first and second ?

Prior. Exactly the same. —— But let us first examine the dike, which forms their reservoir, and is made use of to raise the water to a proper height. This dike, or causey, is sometimes ten, and sometimes twelve feet thick at the foundation. It descends in a declivity or slope, on that side next the water, which gravitates upon the work in proportion to the height, and presses it with a prodigious force towards the earth. The opposite side is erected perpendicular, like our walls ; and that declivity, which at the bottom, or basis, is about twelve feet broad, diminishes towards the top, where 'tis no more than two feet broad, or thereabouts. The materials whereof this mole consists, are wood and clay. These beavers cut, with surprising ease, large pieces of wood, some as thick as one's arm, or one's thigh, and about four, five, or six feet in length, or sometimes more, according as the slope ascends. They drive one end of these stakes into the ground, at a small distance one from the other, intermingling a few with them, that are smaller, and more pliant. As the water, however, would find a passage through the intervals or spaces between them, and leave the reservoir dry, they have recourse to a clay, which they know very well where to find, and with which they stop up all the cavities both within and without : So that the water is duly confined. They continue to raise the dike in proportion to the elevation of the water, and the plenty which they have of it. They are conscious likewise that the conveyance of their materials by land, would not be so easily accomplish'd, as by water ; and therefore they take the advantage of its increase, and swim with their mortar on their tails, and their stakes between their teeth, to such places, where there is most occasion for them. If their works are, either by the force of the water, or the feet of the huntsmen, who run over them, in the least damaged, the breach is instantly made up ; every nook and corner of the habitation is review'd, and, with the utmost diligence and application, perfectly repair'd.

But

But when they find the huntsmen visit them too often, they work only in the night-time, or else abandon their works entirely, and seek out for some safer situation.

The dike, or mole, being thus completed, their next care is to erect their several apartments, which are either round or oval, and divided into three stories, one rais'd above the other: The first below the level of the causey, which is for the most part full of water; the other two above it. This little fabrick is built in a very firm and substantial manner, on the edge of their reservoir, and always in such divisions or apartments, as above-mentioned; that in case of the water's increase, they may move up a story higher, and be no ways incommoded. If they find any little island contiguous to their reservoir, they fix their mansion there, which is then more solid, and not so frequently exposed to the overflowing of the water, in which they are not able to continue for any length of time. In case they cannot pitch upon so commodious a situation, they drive piles into the earth, in order to fence and fortify their habitation against the wind, as well as the water. They make two apertures, at the bottom, to the stream: one is a passage to their bagnio, which they always keep neat and clean; the other leads to that part of the building, where every thing is conveyed, that will either soil or damage their upper apartments. They have a third opening, or door-way, much higher, contrived for the prevention of their being shut up, and confined, when the frost and snow has closed the apertures of the lower floors. Sometimes they build their houses altogether upon dry land; but then they sink trenches, five or six feet deep, in order to descend into the water, when they see convenient. They make use of the same materials, and are equally industrious in the erection of their lodges, as their dikes. Their walls are perpendicular, and about two feet thick. As their teeth are more serviceable than saws, they cut off all the wood, that projects beyond the wall. After this, when they have mix'd up some clay and dry grass together, they work it into a kind of mortar, with which, by the help of their tails, they plaister all their works both within and without.

The inside is vaulted, like the handle of a basket, and is large enough for the reception of eight, or ten beavers. In case it rises in an oval figure, 'tis for the generality above twelve feet long, and eight or ten feet broad. If the number of inhabitants increase to fifteen, twenty, or thirty, the edifice is enlarged in proportion. I have been credibly inform'd. that four hundred beavers have been discovered to reside in one large mansion-house, divided into a vast number of apartments, that had a free communication one with another.

Chev. That was, doubtless, one of their capital cities.

Prior. Some beavers, that are called *Terriers*, reside in caverns, dug in a rising ground, either on the bank of a river, or at some small distance from the water. They dig likewise subterraneous trenches, which run from their caverns to the water, and descend from ten to a hundred feet in depth.

These trenches furnish them with recesses, raised one above another, in which they keep themselves perfectly dry, when the water overflows their lower apartments. When they repose themselves to rest, they spread a sufficient quantity of grass upon the floor, which serves them instead of feather-beds; and cover themselves with a parcel of shavings, which supply the place of mattresses, or quilts.

All these works, more especially in the northern parts, are finished in *August*, or *September* at farthest; at which time they begin to lay in their stores. During the summer, they are perfect epicures, and regale themselves every day on the choicest fruits and plants the country affords. Their provisions, indeed, in the winter season, principally consist of the wood of the ash, the plane, and some few other trees, which they steep in water, from time to time, in such quantities as are proportion'd to the number of inhabitants. They cut down branches from three to ten feet in length. Those of the largest dimensions are conveyed to their magazines by a whole body of beaver, but the smallest by one only: Each of them, however, takes a different way, and has his proper walk assign'd him, in order that no one labourer should interrupt another in the prosecution of his work.

Their

Their wood-yards are larger or smaller, in proportion to the number in family : And, according to the observation of some curious naturalists, the usual flock of timber, for the accommodation of ten beavers, consists of about thirty feet in a square surface, and ten in depth. These logs are not thrown up in one continual pile, but laid one across the other, with intervals, or small spaces between them, in order to take out, with the greater facility, but just such a quantity as they shall want for their immediate consumption, and those parcels only, which lie at the bottom in the water, and have been duly steeped. This timber is cut again into small particles, and conveyed to one of their largest lodges, where the whole family meet, to crunch their respective dividends, which are made impartially, in even and equal portions. Sometimes they traverse the woods, and regale their young with a more novel, and elegant entertainment. Such as are used to hunt these animals, know perfectly well, that green wood is much more acceptable to them, than that which is old and dry ; for which reason they plant a considerable quantity of it round their lodgments ; and as they come out to partake of it, they either catch them in snares, or take them by surprise. In the winter, when the frosts are very severe, they sometimes break a large hole in the ice ; and when the beavers resort thither for the benefit of a little fresh air, they either kill them with their hatchets, or cover the opening with a large substantial net. After this, they undermine and subvert the whole fabrick : Whereupon the beavers, in hopes to make their escape in their usual way, fly with the utmost precipitation to the water ; and plunging into the aperture, fall directly into the net, and are inevitably taken.

Chew. 'Tis a great pity methinks, that they should demolish thus at once a whole family of these poor creatures ; especially since they are such excellent architects, and such shining examples of unwearied diligence.

Cunt. The civet cat, which is an *American* animal, and something larger than our *European* cats, is nothing more, as we are credibly inform'd, than one of these beavers in miniature : And as their inclinations, it seems,

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as well as their labours, are much the same, it would be needless to expatiate on the subject.

Countess. Do you see, Chevalier, what's going forwards on the other side of the moat? 'Tis an affair wherein you are partly concern'd?

Chev. Yes, Madam, I see by their poles and nets 'tis a party of fishing, which your Ladyship has appointed for my farther amusement. I hope his Lordship and the Prior will oblige us with their good company.

Prior. You know, my dear Chevalier, that I am a fisher of men. I wish you all the diversion imaginable in your employment; but you must excuse me for once, and let me have some small regard to mine.

F I S H E S.

D I A L O G U E XIII.

The Count and Countess, the Prior, and the Chevalier.

Countess. **R**ISE, Chevalier: We are come to break in upon your agreeable meditations. 'Tis now about an hour since I first observed you lying on the edge of this basin. What objects, pray, may have engaged so much of your attention?

Chev. A small number of those perch and carp, Madam, which I preserved alive out of your yesterday's fishing. I have been feeding them, and observing all their motions: Upon which a variety of thoughts crowded upon my mind, with respect to the nature of fish in general; and I have twenty questions to propose to his Lordship and the Prior. I would ask them, in the first place, why the water, which suffocates all other living creatures

creatures, should prove no ways detrimental to them. Again, I would fain know what they principally subsist on; and, moreover, how they are able, since they have no feet, arms, claws, trunk, or sting, to advance and secure their prey.

Countess. If your contemplations, Chevalier, always produce such reasonable enquiries, indulge them often: There is no doubt, Sir, but in a short time you'll make some important discoveries. As all your questions are seemingly very pertinent, and perfectly novel, at least to me, I shall listen with the utmost attention to hear them answered.

Prior. I can give your Ladyship some insight into the nature of their food, and the element in which they dwell; but it requires a more delicate philosophy than I am acquainted with to account for their progressive motion, and the manner of their swimming: I must refer you therefore to his Lordship, for satisfaction in those more curious particulars.

I am now going to resume the meditations of our young amiable philosopher. I stand on the edge of the great basin, and fancy myself to be the Chevalier, engaged in the same train of thought. I have always observed that the universe abounds with an infinite variety of living creatures. Some are inhabitants of the air: others range around the fields, or crawl upon the ground. Thousands reside in the utmost recesses of the thickest woods, in the hearts of leaves, and under the bark of trees; some in the chinks and crevices of walls, and others in the most gloomy caverns. The very bowels of the earth are hollow'd, and filled with inhabitants. All these animals, how different soever from each other, with respect to their nature and way of life, enjoy one benefit in common: All of them breathe the fluid air. We have at present, however, another element under our consideration, wherein all of them are stifled, as soon as they are plunged into it. Is there no possibility then of subsisting in the water? And is that element, which covers more than half the globe, entirely uninhabited? — Just the reverse. I therein discover a vast variety of beings, and observe, that as terrestrial animals are suffocated in the waves, so the inhabitants of the watery

regions soon expire in the air, and cannot long subsist out of that element, to which they are consigned: But I cannot rightly comprehend how their blood should circulate with that freedom, which it indisputably does; for one would think it should coagulate and condense by the excessive chillness of the waters. Such animals as live upon the earth, are either furnish'd with feathers, and a delicate down, or invested with warm furs, or long hairs to defend them from the inclemencies of the air, which is sometimes exceedingly cold; but no fish, as I can find, have any such agreeable accommodations. How then has nature provided for them, that they are able to subsist in an element much colder than the air? Let us recollect what we have often discover'd, as we have been accidentally handling a fish, or cutting one open. The first thing that offers itself to our touch, is a certain glutinous matter, with which the whole surface of the creature's body is duly moisten'd. I find, moreover, a coat, consisting of strong scales; and before I come to the animal's flesh, I observe a kind of lard, or oily substance, which extends from head to tail, and surrounds the whole. Tho' I cannot easily conceive how these scales are form'd, or how they gradually increase and are supply'd, or what is the origin and reservoir of this oil; yet these scales, by their solidity; and this oil, by its antipathy to the water, keep the fish warm, and give him life and vigour. He could not possibly be furnish'd with a lighter vestment, or one more impenetrable. Inform me, that which way soever I turn my eyes, I discern a wisdom ever fruitful in new designs, perfectly well acquainted with every circumstance of its operations, and never oppos'd or incommoded by the disobedience of the materials it employs.

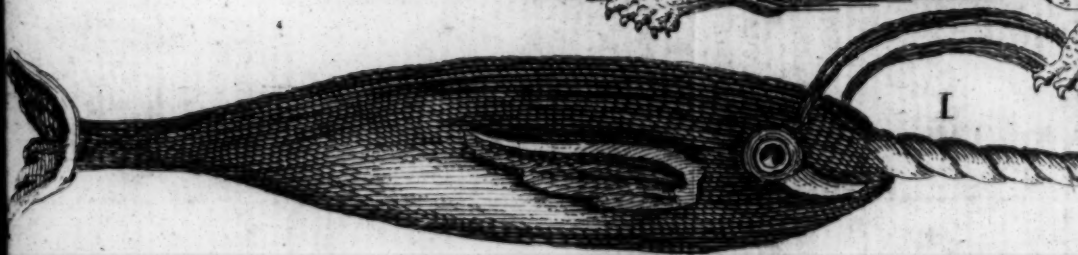
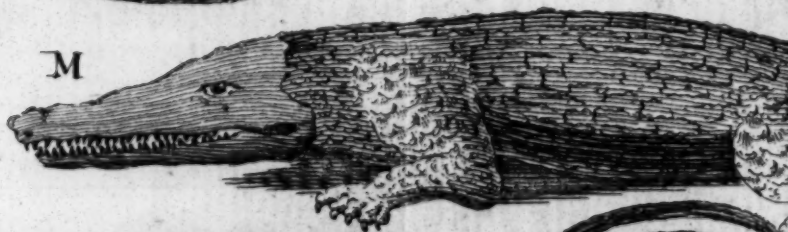
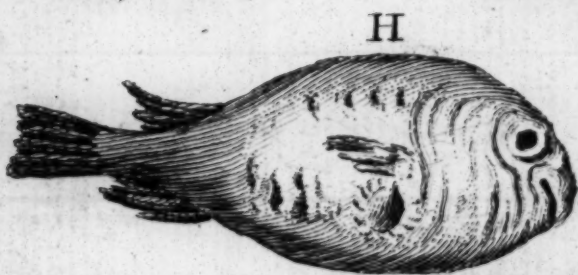
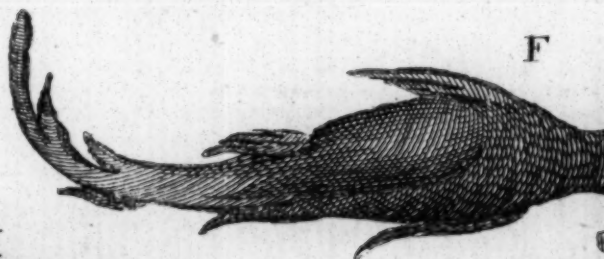
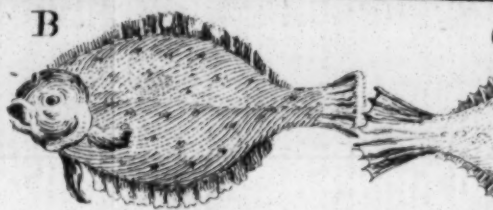
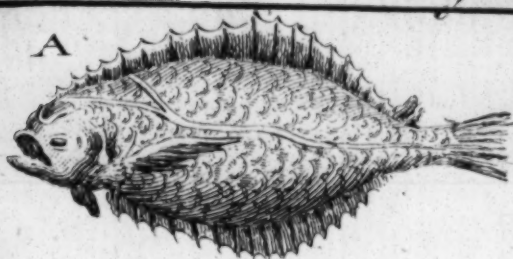
Cher. I meditate mighty well, I find. I am pleas'd, methinks, with my own discourse. Pray, Sir, let us proceed.

Prior. We will—And in order thereto, let us suppose ourselves transported to the summit of some high hill by the sea-shore, from whence our eyes may take a boundless range over that immense basin, which was hollowed by the hand of the Almighty. The salt-waters which are contained therein, are, to all outward appearance,

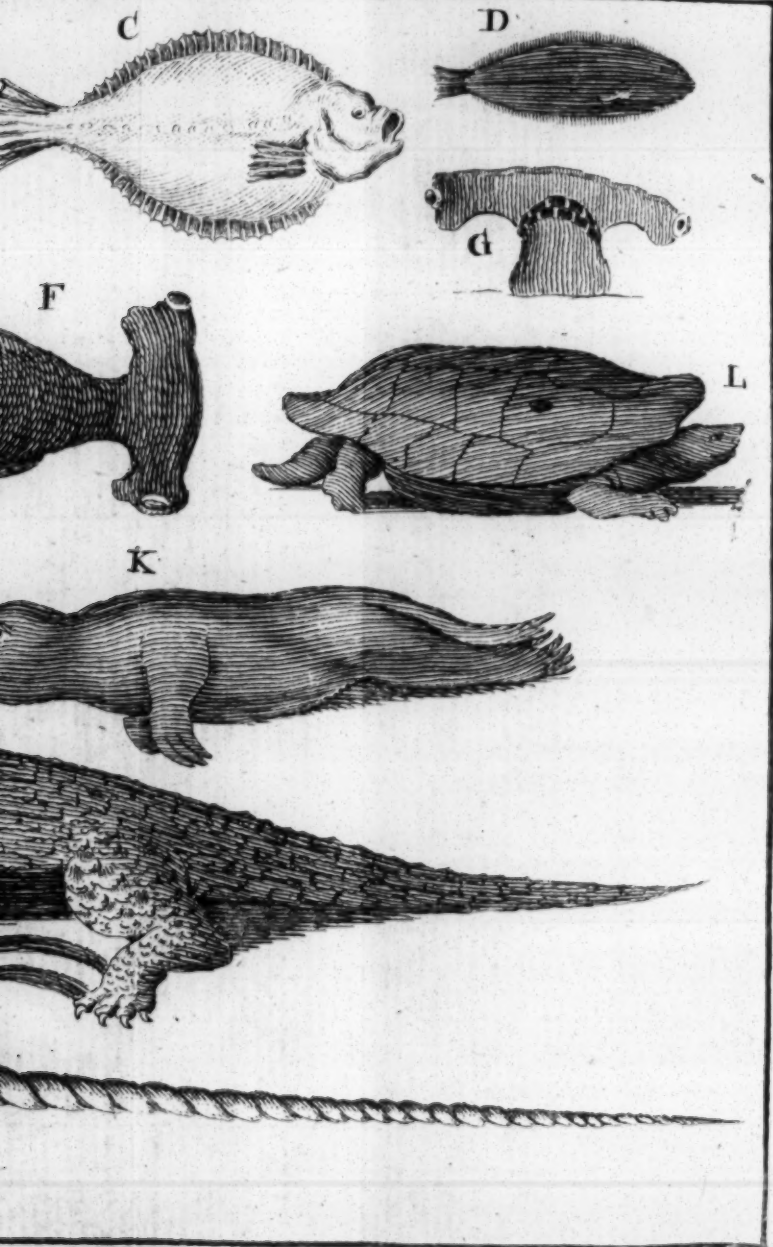
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pearance, very barren; or, in case they do give being to some particular creatures, their flesh is of no service, or support to us. But, alas! I find myself grossly mistaken. When the Great Creator of all things gave to man dominion over the fishes of the sea, 'twas, doubtless, to answer some wise end and purpose; and I can, at this very instant, discern an infinite number of small vessels, sailing from all the adjacent shores, to collect the treasures of the ocean; the owners whereof furnish us not only with an abundance of provisions, but such too as are very nutritious, and agreeable to the taste. Here my astonishment redoubles. Some old experienc'd mariners have made frequent attempts to render the waters of the ocean serviceable to them in their long and tedious voyages; and, as we are credibly inform'd, have met with some degree of success; but could never bring them to such a pitch of perfection, as to make the water palatable, or fit for their refreshment. The sea carries off from the lands, which it washes, a vitriol and bitumen, that, like itself, being in a perpetual motion, disperse and incorporate, in such a manner, with the smallest particles of the water, that no filtrations, no alembicks, or any other devices, how artful soever, have been able to purify, and free it from its brackish taste. 'Tis in this nauseous and offensive water, however, that the All-wise Creator has thought fit to improve, and bring to perfection, the flesh of those fish, which the most voluptuous prefer before the choicest fowls. Tho' these are things that are seemingly impossible, yet they are incontestible. At every step I take, I am conscious to myself, that the Supreme Being constrains me to believe some particular doctrines in nature, as well as religion, of which he has not given me any adequate idea: And, as he has thought it sufficient to discover to me the existence and reality of some wonders, produced by his Almighty Power; so he enjoins me to sacrifice my reason to the nature of his divine operations, and the manner in which he performs them.

Let us continue to coast along the shore, and draw near to one of these fishers, to view the fruit of his labours. In an element that produces nothing, 'tis impossible, one would imagine, that the number, or fertility

tility of the inhabitants, should be any thing considerable. Every thing I see is above my comprehension, and my reason is almost every moment contradicted by experience. What a prodigious quantity of mussels, crabs, lobsters, and other fish of an enormous size, have those fishermen yonder taken, beyond my expectation! What piles of oysters do I behold, whose whiteness and fat give a keenness to my appetite! There are others, I perceive, who have emptied their nets, and, in a very courteous manner, exposed to our view a profusion of turbot, flounders, dabs, burts, plaice, and all the various species of flat fish, whose flesh is so exceedingly admired. In another point of sight, I observe a whole fleet of ships freighted with herrings. This is the season for that fishery. At other times there are shoals of mackerel † and whittings, instead of herrings, which present themselves voluntarily before us upon the coast; in so much that whole provinces are supplied with a sufficient quantity of them by the bare capture of a single day. One would be tempted to think the sea was incapable of containing the inexhaustible treasures with which it teems. Legions of smelts and flounders forsake the salt waters in the spring, and begin to swim up the rivers. Shads follow the same tract, and grow to their full perfection in the fresh water. Salmon continue till *July*, and sometimes later, to enrich the fishers, though three score, and sometimes four score leagues from the sea. Every season regales us with fresh delicacies, without the least interruption of their usual presents, such as lampreys, smelts, tunnies, * goldfish, soles, thornbacks, and a vast variety of other fish that adorn our dishes, and gratify the nicest taste. What a delicacy! what a profusion of provisions do we receive from the indulgence of this element! This very delicacy, however, might possibly so enhance their value, that none but the rich could purchase them; or the plenty might be so great that the corruption of the whole, or the greatest part, might prevent their timely consumption. Both these inconveniencies are, notwithstanding, effectually prevented by a little

† Ruisch. Theatr. Anim. tom. 1.

* Bellon. de Aquatil. The tunny and gold fish are principally caught in the Mediterranean.

little salt. All our fishermen, I find, are employed in barrelling up their herrings, as soon as they have cured them. There are several vessels, at this time sailing in the high-seas, that bring us from *Newfoundland*, a thousand leagues distant from hence, an incredible number of cod-fish, preserv'd by the same precaution. Thus the sea is lavish of her stores, and at the same time furnishes us with salt, which renders their communication easy, and their conveyance safe. The poorest persons, therefore, tho' at never such a distance from the ocean, may by this means partake of her favours, at a very moderate expence. 'Tis not in the power of words to express either my gratitude or admiration. I observe, likewise, in this profusion of the sea, a precaution, which enhances the value of her gifts, and proves an additional blessing. Such fish as are wholesome food, and agreeable to the taste, are exceedingly prolifick; but those, on the other hand, whose flesh is unpalatable, or prejudicial to our health, and whose monstrous size renders them formidable to others, are for the generality viviparous, that is to say, they bring forth their young completely form'd into the world, and seldom more than one or two at a birth. Of this number are the whale, the dolphin, the porpoise, and the sea-calf. The same wisdom that has regulated, with such indulgence, the bounds of their fecundity, keeps those at a wide distance from our shores, which we have the least occasion for; and puts others into our possession, which are of most benefit and advantage to us.

Whales, porpoises, and all the fish of an enormous size, whose awful appearance would alarm those which nourish and support us, and make them scud away, seek the high seas to prevent their being driven on the coasts; where they would be lost for want of a sufficient body of water to support them. An invisible hand directs them to such parts as are abandoned by the rest, and prepares for them a subsistence, hitherto unknown, under the congealed waters of the north, and all along the seas, that lave the coast of *Greenland*, to which it impels them for the maintenance and support of the poor inhabitants, whom it seems unwilling absolutely to neglect. These miserable people eat the flesh, and drink the fat

fat when melted down. They make use likewise of the bones and skin for building, as well as lining those skiffs, in which they fish.

On the contrary, all the other species come in shoals to our coasts; some are with us all the year long, and others pay us an annual visit in prodigious multitudes. The exact time of their passage, and their peculiar track, is perfectly well known, which are very advantageous circumstances. We may form an adequate idea of other fish of passage from the before-mentioned herrings and cods. The former seem to have their principal rendezvous between the points of *Scotland*, *Norway*, and *Denmark*. From thence the *Danish* colonies take their annual progress, and, at different seasons, cross the channel; and, soon after their departure from *Holland* and *Flanders*, visit our *Neustria*. These, however, are not a gang of *Banditti*, that rove about at random. Their voyage is annually perform'd with the utmost exactness, *June* and *August* are the two stated periods for their being in motion. Their track is prescrib'd, and their march regulated. The whole body move at once. Not one of them presumes to straggle, pillage, or desert. They continue their march from one coast to another, till the appointed period. They are a numerous nation, and their passage long: When the body, however, of their army is once pass'd, not one of the same species appears again till the year ensuing. Some speculative gentlemen have attempted to find out the secret motive that inspires the herrings with that taste for travelling, and that policy which is so inviolably observed amongst them. Some *English*, as well as *Dutch* fishermen, have taken particular notice, that an infinite * number of worms and little fish are bred every summer in the channel, with which the herrings regale themselves. They are a sort of manna, which these animals never fail of picking up; and when they have absolutely cleared the seas, in the northern parts of *Europe*, they descend towards the south, to which they are attracted by the pleasing prospect of a new stock of provision. Should they chance, however, to meet with a disappointment, they steer another course for their subsistence: The pas-

sage,

* Lceuwenhoeck, Ep. Phys. 42.

stage, indeed, is perform'd in less time, but the fishery is not near so advantageous.

We have but very few cod-fish in our seas. Their general rendezvous is at the immense bank before *Newfoundland*. There they keep their festivals, and are so numerous, that the fishermen, who resort thither from all parts, are constantly employ'd, and find their labours attended with surprizing success. One man shall sometimes catch three † or four hundred in a day. When the sustenance that attracts them is exhausted in these parts, they disperse, and proclaim open war with the whittings, which are their favourite aliment. The latter fly before them; and their ‡ frequent returns upon our coasts are principally owing to this hostile chase.

Having mention'd their wars, I remember one circumstance, which, as I have been told, reigns through the whole species. The mussel lies in ambuscade within the mud; there she opens her shells; and when a small, unwary crab presumes to creep in, she claps them close together in an instant, and secures her prey. The oyster takes the same measures to ensnare such little fish as are not on their guard. The sole, and most flat fish lie conceal'd likewise in the soil, to the colour whereof their backs bear a near resemblance, and observe, with the utmost circumspection, where the females of large fish sink commodious lodgments for their spawn, whereon the males afterwards diffuse their impregnating fluid, to render such spawn prolific. The sole springs instantaneously from the ambuscade, and regales herself with this delicious food, which pampers her up, and gives her an exquisite flavour. The small soles, in their turn, are equally an agreeable collation to the large crabs; and as they seldom abandon the gravel, where they are perpetually in search after the spawn of fish, there is scarce any of the species, how small soever, but what partake of some share of them; and when we open the former, we seldom fail of finding a small sole or two in the belly of them. You may form an idea of the other species by this. All the several classes of living creatures that breed in

† Savari Dic. de Comm.

‡ Leeuwenhoeck, *ibid*.

in the water, from the biggest to the least, are constantly in action, and at war with each other. 'Tis one continued series of artifices, flights, evasions, and open violence. They pillage, and devour one another, without remorse or moderation. In short, the conduct of fish bears a near affinity to the practice of mankind, and I wonder for my part, that no one has attempted to prove them to be rational creatures. But a more serious thought at present occurs to me. If the inhabitants of the watery regions have such a watchful eye upon the scattered spawn, and are thus addicted to devour one another, this element, one would think, must, in process of time, cease to be replenish'd; and, indeed, have long ago been absolutely uninhabited; for since the lesser fish are the proper sustenance of the larger, the former must of course have been all destroy'd; and the latter, in their turn, must have perish'd for want of proper subsistence. Nothing, however, can be more trifling and impertinent, than the animadversions of man on the works of his Maker. The * Almighty has taken proper measures for the preservation of fish, by giving strength to some, activity and circumspection to others; and by a multiplication of them to such a prodigious degree, that their fecundity exceeds their natural bent and inclination to prey upon each other. Such too as are destroy'd, are by far less numerous, than those who survive to renew the species. Be the number of cods ever so great, that have been caught this year, or devour'd in the sea by the invasion of their enemies, there is still a remainder of that tribe, which is more than sufficient to furnish us with as large a quantity about two years hence. The fact is demonstrable by the following instance. When I went with some friends to take a view of the port of *Dieppe*, a fine fresh codd was produc'd before us, but much inferior to those which are brought from the grand bank. I had the curiosity to count her eggs, for which purpose I took as many as weigh'd a dram. These were told over by three of us. We agreed within a trifle in our computation. After this I weigh'd the whole mass of eggs, which, allowing eight times the number to every ounce, amounted to no less

than

than nine † millions, three hundred forty-four thousand eggs.

Countess. As incredible as this account may seem to be at first view, I readily acquiesce in the belief of it. The quantity of eggs so frequently found in a common carp, though far short of the number contain'd in a large cod, is so surprizing, that I am fully satisfy'd the Prior's calculation is just. I can assure you it strikes strong upon my imagination, and inclines me to weigh it well, or rather, to make some serious animadversions upon it. When we come to search into the wise end and purpose of this amazing fertility, we are immediately convinc'd, that it is not to replenish either the rivers, or the sea, with the same quantity of fish, as there are eggs: For were it so, the ocean itself, in my opinion, would scarce be able to contain them: 'Tis manifest, however, that there is a double intention in this fecundity; in the first place, to preserve the species, whatever accidents may happen; and in the next, to furnish the surviving fish with a plentiful and succulent subsistence.

Chew. I now perceive, in some measure, the manner in which the fish are nourish'd and preserv'd: And since I find that there are such an infinite number of worms, shell-fish, eggs, roes, and minute fish lodg'd within the waters, I am in no manner of concern for the inhabitants, with respect to their provisions: They have, I perceive, their certain allowance; but then their aliment lies conceal'd, or flies before them; and I can discern nothing in these fish but a head, a large inactive body, and a tail. As they have so few organs, how are they capable of advancing, swimming, and seizing on their prey? There is another circumstance likewise, which I cannot fully comprehend. Before I threw my last carp into the water, I took out my scissars and clipt his fins, imagining that by means thereof he would be rendered incapable of swimming; but contrary to my expectations, he advanc'd, struck down to the bottom of the bason, and rose again: He was always turn'd, I confess, either on one side or the other, or with his back downwards, and could never swim, as before, upon his belly.

Countess.

Countess. The poor Chevalier will have no rest to-night, my Dear, if these obstacles are not remov'd.

Count. Then I'll undertake to clear up the account. The form, or figure, of all fish in general being straight, and growing always somewhat taper at the head, enables them to traverse the water. The tail, by the assistance of the mussels, is exceedingly pliant, strong, and active; inclines to the right and left, and, when reduc'd to a direct line, repels the water that lies behind it; immediately it resumes its playing, and, by this alternate motion, advances the head, and, in short, the whole body, in a much more agreeable manner than an oar, at the stern of a boat, and work'd alternately to and fro, conveys it up a river. The fins, which lie under the fishes belly, are sometimes of singular service; not only in repelling the water, and advancing the body; but in stopping its course, when they are extended, and lie at rest: Their peculiar office, however, is to direct the movement of the body, by keeping it in an equal poise; so that in case the fish should only move the fins on its right side, and bring those on its left close to its body, all the motion is in an instant determin'd to that side; just as a boat, that has two oars, when but one is made use of, will infallibly turn to that side whereto it is impell'd by the working of the other. If you cut off a fish's fins, the back, which is heavier than the belly, being no longer in an equilibrium, will either lie assant, or be turn'd directly up; as is the case with dead fish, whose fins lie always on the surface of the water.

Chev. I think, my Lord, I conceive, in some measure, how a fish's tail, when in a direct line in the water, is qualify'd to strike on one side and the other, and by that means to advance the body: As this tail, however, is but of a thin substance, 'tis incapable of driving the water either upwards or downwards. For which reason I cannot comprehend how it can possibly rise or sink.

Countess. Very well obser'd, Sir. The same difficulty has frequently embarrass'd me too. Let us see how his Lordship will solve this knotty point.

Count. I was apprehensive of the objection, and therefore have my answer prepar'd in this paper. Can

you

you tell me, Chevalier, what this is which I here shew you?

Chev. 'Tis, if I am not mistaken, my Lord, a carp's bladder.

Count. It is so; and most fish have one of the like nature, or at least something equivalent * to it. Though 'tis what we see every day, yet we speak of it in ambiguous terms. Besides, the use of it is quite different from what most people imagine. This suppos'd bladder, is a bag of air, by virtue whereof the fish are enabled, according to its enlargement or contraction, to rise or sink.

Nothing is more easy to be conceived; and the least attention imaginable will convince you of the fact. In the first place, lay † it down as an incontestable maxim, equally consistent with experience and good sense, that a body will swim upon the water when 'tis lighter than that quantity of the fluid whose place it fills. If a board of an inch square and two inches thick, be of equal weight to a body of water of the same dimensions, it will swim with its surface equal to that of the water; if but half as heavy, then half its thickness only will sink into the water; but if it be too solid, and more ponderous than a like quantity or mass of water, it will sink to the bottom.

In the next place, a body is more ponderous, according as the parts of it are more compact, and contain in them a lesser quantity of air; and lighter, according as they are porous, and contain in them a larger quantity of air. A bottle that is full of any liquid whatever, will sink in the water; because the bottle and the liquor contained in it are heavier than the mass of water of the same dimensions. The same bottle, however, fill'd with air, will swim on the superficies; because the bottle and the air in it are lighter than the quantity of water whose place they possess. In short, all bodies will sink, if not in an equal poise with a mass, or quantity of water of equal weight.

This position allow'd, the body of a fish, which is heavier than the mass of water, whose place it possesses, would

* Borelli de Motu Anim.

† Transact. Phil. n. 114. and 115.

would unavoidably sink to the bottom, had not the fish in its intestines a vessel, or bag, fill'd with air, which renders him capable of sustaining himself in what particular part of the water he sees most convenient for his purpose. This bag dilates the fish, in some measure, and makes some small improvement to his natural bulk, without any addition to its weight : which is a circumstance duly to be consider'd : For by this means he possesses a larger space than he would do without it, and this brings him to an equal poise with that body of water whose place he fills. Let us suppose the fish, without his bag, to weigh sixteen ounces, and the water, whose place he occupies, to weigh fifteen only, the fish must unavoidably descend. If, however, you should afterwards supply the fish with a small bag of air, which adds nothing to his weight, but enlarges his dimensions, this will take up a larger space. If the mass of water, whose place he fills, weighs sixteen ounces, the fish will be in an equal poise with that mass, and will then be supported in any part of the river, be he where he will.

Chev. Hitherto all is right. I am convinc'd, that the fish is able to swim, and advance in a direct line ; but am still at a loss to know by what means he rises and sinks.

Count. Was he able to enlarge his bag, and introduce a larger quantity of air, what would then be the consequence ? 'Tis a circumstance that I'd advise you to take into your consideration.

Chev. Could he extend his bag, he'd enlarge the dimensions of his body without the addition of any weight. I am sensible, my Lord, that as he fills the space of a greater quantity of water than before, he must be lighter than that body ; so

Count. That is not all. If he becomes lighter, he'll rise. On the contrary, should the fish contract his bag, what will be the consequence then ?

Chev. He will decrease in his dimensions, and take up less space, without any diminution of his weight, whereby he must become heavier than the water whose place he occupies, and by consequence, must sink. But 'tis highly improbable, my Lord, that a fish should be

able to contract or dilate this bag every moment, according as he is dispos'd to rise or sink.

Count. How improbable soever it may seem, Sir, 'tis what he actually does; and what has been evinc'd by incontestable demonstrations. This bag of his, for the generality, has two small, but distinct partitions: One, which is always, it seems, equally full of air, in order to keep the fish in an equal poise with the mass of water whose place he fills: The other is dilated or contracted, to enable the fish to become lighter or heavier, or, in other terms, to rise or sink, as occasion requires.

Chev. What, Sir! Is it possible that a fish should have the air at his command in the water?

Count. The water abounds with particles of air, diffus'd through the whole. What we generally call the gills of a fish, are a sort of lungs, or the trachian artery, which he opens for the admission of air, and which are form'd with such a peculiar mechanism, that they receive it without the least intermixture of any water. The air indisputably flows into the bag through them, and by virtue thereof the fish ascends: But when he is inclin'd to sink, he has nothing more to do than to contract his bag; for the air immediately re-ascends to the gills, and has a free, and uninterrupted passage. The fish thereupon sinks to the bottom, and the rapidity of his descent is proportioned to the quantity of air that is rejected.

Chev. The information which your Lordship has given us, is, in my opinion, very curious; and I don't question but the fact is confirm'd by experience. I propose, however, for my further conviction, to make the cook prick the bladder of one of my carps, and let the air out. The creature will not die, I presume, instantly, and I shall then see the result of the operation.

Count. You'll do mighty well. I am pleas'd with all such young Gentlemen, as begin betimes to make their experiments, and proper reflections upon them: For by such laudable attempts, they improve their judgment: And nothing is so sure and certain in philosophical enquiries, as ocular demonstrations. But as to your intended

expe-

experiment, I have made it myself some years ago. You have seen, I presume, my air-pump, which extracts that element out of a crystal glass, or any other vessel, wherewith 'tis cover'd. Not long since I made an experiment with it upon a live carp. As soon as the air was pump'd out of the vessel wherein it was enclosed, I expected every moment that the air, which remained in the fish's bag, would be expanded; because that element is always endeavouring to accomplish its enlargement, and because at that time there was no air from without to gravitate on the carp. The affair answer'd my expectation: The air, dilating itself in the bladder, bloated the fish to that degree, that his eyes started out of his head, and at last the bladder burst within his body. The carp notwithstanding didn't die; but, as I threw him instantly into the water, lived above a month after the operation.

Chew. He never † rose again, I presume, in the water.

Count. No, Sir; ‡ but crawled at the bottom like a serpent.

Count's. What surprising effects are produced by these bags of air! Your fish must, doubtless, be very profound philosophers, to know precisely to what degree they ought to dilate and contract them, according as they are disposed to rise or sink, and to be capable of opening or shutting the air-vent, in a proper manner, for any particular degree of elevation in the water.

Count. Our judgment must yield to experience. This difficulty, however, is sufficiently removed by reflecting only that all the operations are perform'd by them without their being any ways conscious of what they do. And the regular execution of them, tho' no proof or discovery of any knowledge or attention in the animal is an incontestable demonstration of the infinite and unsearchable Wisdom of the Great Author of its being. With regard to man himself, who is endow'd with rational faculties for the regulation of his actions, how many of them do we see perform'd without his privacy or participation? How many are there now living

† Borelli *ibid.* part 1. prop. 209.

‡ Lowthorp's *Abridg.* Vol. 2. p. 345.

who have no idea either of the structure or use of their lungs? How many, in short, are insensible of the raving any lungs at all? We dance a minuet or rigadon, sink and rise to the music, and throw ourselves into a variety of attitudes, without the least knowledge of what nerves we ought to extend, what muscles to expand or relax, for the more graceful accomplishment of such or such a movement.

Countess. Gentlemen, tho' I am not fond of entering into debates, yet you must excuse me, if I insist upon the explication of one point, as I imagine it inconsistent with what you have advanced. I may speak with some assurance of a thing which presents itself daily to my view. Have lobsters, who lie in the water, any bag like that you have been talking of? Or is it to be met with in crabs or tortoises, who live either out of, or in that element, as occasion offers? Can any thing like it, in short, be discover'd in soles, or plaice, or any other flat fish whatsoever?

Count. 'Twould be labour lost to examine those creatures in that particular; for they neither have a bag, nor the least occasion for one. Cray-fish, † oysters, lobsters, and crabs, as well as soles, plaice, and all manner of flat fish, lie always at the bottom of the water; for which reason such air-bag would be of no manner of service to them; and of but very little to the tortoise. ‡ The latter, 'tis true, has been observ'd to swim sometimes; because, as she has lungs, she can enlarge her dimensions by the admission of air, and put herself in an equilibrium with the water. For the generality, however, she contents herself with humbly crawling on the ground.

Clara. I have observ'd, indeed, that those which are now in your basin, never swim, but crawl on the earth, when in the water, as well as on the shore. One may observe them ascend from the bottom of the water, by the assistance of a plank, in order to take a tour on the green grass, and then return, by slow degrees, to the place from whence they came. This is an amphibious

Vol. I.

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creature

† Lowthorp's Abridg. Vol. 2. p. 845.

‡ Rondellat, lib. 1. c. 10.

creature of a quite different structure from all the rest. I could wish his Lordship would give us a transient account of the various species of this animal, who are of any material service to us. For instance, are these tortoises of yours, the same with those whose shells are commonly made use of for snuff-boxes, and other toys?

Count. Their shells may serve for that purpose; but they are too small, and of too common a sort. There are four or five several species of this animal; but the *Turtle* and *Carret* are most in repute. The shell of the former, indeed, is not extremely beautiful, but its flesh* and eggs are exquisite in their kind, and highly valued by our mariners, who find them not only a refreshing aliment, but an incomparable anti-scorbutick, in their long and tedious voyages. A single tortoise will sometimes produce near two hundred pounds of flesh, which is generally salted as soon as catch'd, and about three hundred eggs, which are very large, and will keep good a considerable time.

The *Carret* † is a very large tortoise, as well as the other. The flesh of it, 'tis true, is not altogether so delicious; but 'tis much valued for the beauty of its shell, which is easily cast into what form the workman thinks proper, by making it soft and pliant in warm water, and afterwards clapping into a mould, the impression whereof it instantly takes, as soon as put into a proper press. After this 'tis polish'd, and chased with gold or silver, or otherwise embellish'd, as fancy suggests, or the operator is particularly directed.

Chev. Before we conclude our discourse on tortoises and lobsters, I should be glad to know in what manner they subsist; for in case they never swim, I should think their prey might, with all the ease imaginable, escape them.

Count. Cray fish and lobsters are provided with two strong claws, wherewith they secure their larger prey, that inconsiderately happen to approach them. As to the lesser, they grovel in the mud and sand in search for worms, who make their retreats there. They drag them

out

* D'ſſion, Savari.

† Ibid.

out of their cells with their minute pincers, and find their provisions ready drest.

As to the tortoise, she feeds on grass, both in the water and on the land. She makes her usual abode, † and finds the greatest part of her subsistence, in some certain meadows, at the bottom of the sea, not far distant from the islands of *America*. The water in some of those parts is not many fathoms deep; and, as we are credibly inform'd, when the sea is calm, and the weather fine, the tortoises are frequently seen crawling along their verdant carpet. After they have fully gratify'd their appetites, they take a tour to the mouth of some adjacent river for fresh water: There they take the air almost every quarter of an hour; and when sufficiently refresh'd return to their old situation. When they are not feeding, they swim, for the generality, with their heads above the water, except they are apprehensive of danger, either from some hunters in view, or some birds of prey; in either of which cases, they plunge in a moment to the bottom. They pay their annual visits to the shore, in order to deposit their eggs in some hollow lodgments which they make in the sand, a little above the bank, where the surges beat, and roll over one another's heads. There they cover them, as lightly as possible, that the sun by his genial heat may hatch their young: And whilst they are thus solicitous for the welfare of their family, they not only furnish man, but the birds too, with provisions in abundance; for they lay three times successively, at the close of every fifteen days, and produce, for the generality, fourscore, or fourscore and ten, and sometimes an hundred eggs at each deposition.

At the expiration of about four or five and twenty days, the young tortoises begin to rise out of the sand, and march, by slow degrees, without either guide, or any previous instructions, towards the water; but the surges of the sea, to their great misfortune, for some few days, beat them back upon the shore. Thus exposed, the birds flock round about them and carry off the greater part of them, before they have strength sufficient to withstand the swelling waves, or dive down to the bottom.

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Thus,

Thus, out of three hundred eggs, scarce ten escape; and sometimes the whole fecundation is destroy'd.

Countess. Was our neighbour, captain ***** here, with what pleasure would he pour out his invectives against nature, and without the least hesitation, charge her with an act of injustice! Give me leave, for once, to put on an air of self-sufficiency; and should I talk at random, and censure Providence itself too freely, excuse my impertinence on this occasion. Was the captain here, I say, his address would be couch'd, I presume, in the following terms: "Are not you a set of dreaming philosophers, to pore thus on such trifles, as men of common sense would think unworthy of their notice? Were I in your place, I'd either pluck my eyes out, or make a proper use of them. Now, Gentlemen, weigh but this very subject of yours impartially, and I am persuaded your admiration will soon be at an end. You make a mighty merit of the fecundity of a tortoise, and look upon it as a miracle in nature. Now, for my part, I, who view all things without prejudice, must either ascribe it to mere chance, or pronounce it to be one of Nature's most conspicuous imperfections. Three hundred eggs, and not ten of them come to maturity! 'Tis two hundred fourscore and ten too many; an unnecessary expence! And when the whole brood is destroy'd 'tis no better, in short, than a shameful neglect of her own operations."

Prior. 'Tis his style exactly, Madam.

Countess. Rather say his prophane babbling. I have been personating not only a madman, but one of the most dangerous species. Let me now resume my senses, and talk calmly, like one whom God Almighty has endow'd with reason. We are never disposed to complain of the hen's fecundity, who produces, for the generality, near three hundred eggs a year, when not one single chicken is suffer'd to be hatch'd. We are conscious to ourselves, that the design of the great Author of nature, in this amazing fecundity of hers, is to render the preservation of the species more easy, and, at the same time, to oblige, not only man, but divers other animals with the most delicious food. Thus, in the operations of nature, there is no error or imperfection; nothing lost. There is a

wisdom

wisdom conspicuous even in the slow progressive motion of a tortoise. Were she more active and expeditious, what a number of other creatures would be disappointed of their principal subsistence!

Prior. Let us now pursue our reflections on the manifold benefits and advantages arising from the various species of the finny race. We shall plainly perceive, in the examination of the whole, fresh motives to adore and magnify that Supreme Being, who has filled the waters, as well as the earth and air, with such a variety of good things.

Count. Even such fish as are disagreeable to our taste, are still of some service or other to mankind. We have already hinted, that the northern fish, whose oily flavour is unpalatable to us, are the chief sustenance and support of other nations. Their very fins, scales and most minute parts, are of singular service to some people. There is one fish in particular, whose fins are so strong, that the *Greenlanders* use them, instead of needles, for sewing the skins of wild beasts, which are their usual apparel, and are tack'd together with strings composed of the dry'd intestines, instead of thread.

The *Greenlanders*, likewise, build the hulls, or bodies of their boats, with whale-bones, and line them afterwards, either with the skins of sea-calves, or whales themselves. A man sinks half his body into the cavity of one of these boats, wherein he sits with his feet extended; and the skirts of his upper garment perfectly cover the round aperture wherein his body is fix'd. Thus seated, and having in his left hand a little paddle, or oar, with a double blade, and in his right hand a harp-iron, he skims along the surface of the water, dreads no storms or tempests, and attacks all the whales and porpoises he meets with, which are his principal subsistence. These boats do more service, run swifter, and are more secure than ours; for 'tis morally impossible to overtake them.

Chev. Why then don't we make use of such skiffs, as well as they?

Countess. Would you have it said, Chevalier, that the *Europeans* should receive any instructions from so barbarous

barous a people as those of *Greenland*? We have all the knowledge, doubtless, within our selves.

Count. There is a certain fish in the northern seas, from whom the *Muscovites* extract a glew which is very beneficial. It clarifies our wines, without participating of any of their good qualities, or communicating the least tincture of its own. Our manufacturers make use of it in strengthening and polishing the warp of their works: And where even strong glew will have no effect, this is often substituted in the room of it with good success.

The *Danes*, and other people of the north, frequently catch a large fish, call'd a *Walrus*, or a *Narwal*, whose teeth are in more repute than those of the elephant, because they are an ivory superiour by far in whiteness, and not subject to grow yellow. This animal's left jaw is furnished with an ivory horn, about fourteen or fifteen, and sometimes sixteen feet in length. Some of these horns, which are to be seen in the closets of the curious, have been palm'd, time out of mind, upon the injudicious, for those of the unicorn, who is a creature absolutely chimerical; * at least altogether unknown to the moderns, whatever knowledge of him the antients might possibly have.

But of all the species of fish, whose flesh is ungrateful to the taste, the whale is, beyond all contradiction, the most profitable. 'Tis an animal of a most enormous bulk, (one hundred and thirty, one hundred and sixty, and sometimes two hundred feet in length) and of singular benefit and advantage to such as are engag'd in the *Greenland*-fishery.

Chev. How is it possible, pray, such a monstrous creature should be ever caught? One would imagine he should rend and devour all before him.

Prior. As the fishery is extremely curious, I'll give you a transient idea of it. 'Tis carried on in the most northern parts of *Europe*, to which a great number of pinnaces, † and other small vessels, erected for that particular purpose, frequently resort. When a whale ap-

pears

* The unicorn is a creature of a quite different form, from the idea which is generally entertain'd of him. See Bochart's *Hierozoic*.

† Savari.

appears in sight upon the water, one of the most experienced and adventurous fishermen takes a harping-iron, that is, a javelin, well pointed with steel at one end, and about five or six feet in length, to which is fasten'd a line above one hundred fathoms long. If once he can but dart this instrument into the fat or flesh of the whale, his point is gained, and the unwieldy animal, thus struck, plunges with the utmost precipitation down to the bottom. His associates let the line run out as fast as possible. Whenever it happens to prove too short for their purpose, they fasten a large gourd, hollow'd within, and well closed up, to the extremity of the line; the motion whereof they diligently observe at a distance, that they may the better find their line, and, by that means, the place where the whale lies concealed. After the loss of a large quantity of blood, the hideous animal either appears again upon the surface of the water, or is hauled up by his pursuers.—Having succeeded thus far, they give the finishing stroke to their labours, get him safe to shore, and there cut him into a thousand pieces.

Chev. Since the flesh, as you observe, is seldom eaten; to what use, pray, is it principally applied?

Prior. An hundred rundlets of oil are frequently extracted from the fat of a small whale, that is not above threescore, or threescore and ten feet in length; but the produce of one two hundred feet in length, will amount to sixteen or twenty tons.

Chev. What, pray, may this oil be good for?

Prior. A considerable trade is carried on with this single commodity. In the first place, 'tis used in the dressing some certain hides, and in thickening such pitch and tar, as are proper for the caulking of ships. Then the wool-combers and soap-boilers consume a large quantity of it. Painters likewise mix it with their colours, and physicians with their medicinal ingredients. 'Tis more universally used, however, and of much more service in the north than any other parts, where it supplies the poor inhabitants with a lasting light, at little or no expence, in the long darkness of those melancholy regions.

Countess. Do these monstrous fish furnish us with that whale-bone which we purchase of the merchants?

Count. There are two sorts of fish, which go under the denomination of whales. One is small, has teeth in his head, and his brain produces that white substance, which is called *Sperma Ceti*, * and is in such high repute among the ladies. The other is large, and has no teeth; but, to compensate for that deficiency, he has two large tusks, about twelve or fifteen feet in length, which rise out of his jaw, and are employed, instead of rakes †, to amass the weeds together, which are generally imagined to be his principal support; since large quantities of them have been frequently dragged out of his stomach. These tusks, split into sundry small pieces, are the imaginary whale bone we buy of the merchant; and which is now so profusely made use of, in the structure of the ladies hoop-petticoats: A mode of dress that is altogether preposterous, disagreeable, senseless; in short,

Countess. Hold, hold, my Lord; no invectives against our fashions, I beseech you Let us keep close to our text. Your unweildy whales put me in mind of that amphibious animal, which, according to the description you gave us of it some days ago, is above one hundred feet in length.

Count. You mean the *American* crocodile. . . . I would not, however, rely too much on the accounts given us by old *Spanish* ‡ travellers, who are too fond of the marvellous, and make unmerciful additions to their stories. The crocodile that resides in the *Nile*, the *Niger*, and some other rivers of *America*, is nothing near so long. There are some fifteen, eighteen, and twenty feet in length; but few or none above twenty-five. That extent, however, is sufficient to constitute a monster, and render his appearance awful and tremendous.

Chew. Is not this the animal that resembles a large lizard; has jaws arm'd with teeth, rang'd like those of a saw, and a body and tail covered over with large, impenetrable scales? Is not this, in short, that creature, which, according to all accounts given of him, allures young children to their ruin, by his hypocritical manner

* Savari Pomet.

† Savari.

‡ See Bochart's *Leviathan*, Hierozoic. lib. 4.

of address, when he discovers them at play on the brink of the river where he lies concealed?

Count. The very same.

Prior. Was this animal as prolific as some others, he would soon lay waste the whole human species. God Almighty, however, has given him two implacable enemies; that is to say, the *Sea-horse* and the *Ichneumon*, who are perpetually finding new ways and means to accomplish his destruction.

The sea-horse * is a very large amphibious animal, whose residence is at the bottom of the *Nile* and the *Niger*; from whence he rises, not by the dint of swimming, but by walking on his four feet, into the adjacent meadows, or the tops of mountains, when in search for pastures. He eats grass, or other cattle, and then returns to his watry habitation; where he is engag'd in everlasting war with the crocodile.

The *Ichneumon* † is a water-rat, or small sea-ferret, that is a perpetual torment and terror to the crocodile. Some say, this formidable little creature steals down his throat, when he's asleep; preys upon his entrails, and at length kills him with excess of pain. Having made a complete conquest over him, he regales upon his dead carcase at his leisure. Others assure us, that tho' they are strangers to this particular circumstance, yet they have often seen the *ichneumon* jump, with the utmost eagerness, upon the eggs that have been left by the crocodile upon the sand, and use his utmost endeavours to destroy them.

Count. If the Chevalier has an inclination to see the figures of these three animals, he must go to *Tuilleries*.

Chev. To what particular part, my Lord?

Count. Have you not observed a statue there, which represents the *Nile* and her fourteen children?

Chev. I have often seen it, I confess; but never rightly comprehended the statuary's design. I should be glad to hear an explication of the various figures that surround the pedestal.

Count. The fourteen children of the *Nile*, some whereof are disposed above, and others below, are the

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symbols,

* See Bochart's *Behemoth*. Hierozoic. l. 4. c. 15 16.

† Ibid.

symbols, or emblematic representationss of the various rungs of that river, which are always very advantageous to *Egypt*, when they ascend fourteen cubits high ; but portend a famine in the country, when they keep below that mark. In case the river should swell to fifteen cubits, plenty infallibly ensues ; if to sixteen, the consequence is fatal. Fourteen cubits, however, are the necessary standard. Under the figure of the river-god, inclining on his urn, is a large bed of white marble, round which you'll see, in basso relievo, the various objects that are peculiar to *Ægypt* ; that is to say, the *Latus*, of which the inhabitants make a kind of bread, or broad thin cakes ; the bird *Ibis*, a kind of fowling, that clears the country of their serpents ; and the ichneumon, in conjunction with the sea-horse, engaged in combat with the crocodile.

Countess. I have indulged you, Gentlemen, to day, in your own discourse : But, for the future, I shall exert my authority, as president of this assembly, and confine you to such topicks as are more familiar, and more within my knowledge. I propose, therefore, for our next conference, the article of plants, with their flowers and fruits, and expect your ready concurrence.

P L A N T S.

DIALOGUE XIV.

The Count and Countess, the Prior, and the Chevalier.

Countess. **C**hevalier, in a short time, we shall make you a proficient in all the arts. You have already gone through those of a huntsman, a weaver, a fowler, and a fisherman ; and to day we propose

to give you some insight into the occupation of a gardener.

Chew. As there are vast numbers of animals, of which as yet not the least mention has been made, I should be glad, methinks, if his Lordship, before we depart from the subject, would give us a short detail of those in *Russia*. I find by his collection, which he permitted me to peruse yesterday, that they are very numerous. 'Twould be a novel, and, I fancy, a very agreeable amusement.

Count. This is the very inclination with which I was fond of inspiring you. Every living creature, indeed, is an object worthy of your notice and attention; but we would not either exhaust our subjects, or embarrass you with too many particulars. All we aim at, Sir, is to give you a taste for these entertainments; and, having once made you sensible that considerable improvements may be made on what we have advanced, to submit the rest to your own enquiries.

Countess. But do you really think, Chevalier, that we depart from our subject of terrestrial animals, by turning our conversation upon plants? I am persuaded you do not; for tho' these creatures are incapable, 'tis true, of walking up and down, yet they have their peculiar aliment, and become the parents of a numerous offspring, as well as those who transport themselves from place to place.

Prior. What her Ladyship has advanced in an air of gaiety and humour, has something in it that nearly resembles truth. The root furnishes the plant with a stomach, for the digestion of its food. The bark is, as it were, the skin, that covers all the vessels; the trunk is its body, and the sap which flows from the root to the branches, and from them to the root again, bears a very near conformity to the circulation of the blood in the bodies of living creatures.

Count. What is your real opinion, Doctor, of this pretended circulation of the nutritious juice? Are you fully persuaded that 'tis fact?

Prior. Every circumstance, my Lord, seems to favour the conjecture. But, before we enter into a particular examination of that article, 'twill be necessary, in the

first place, to consider the origin of plants; in the next, to enquire into the essential parts whereof they are composed; and then proceed to the manner in which they receive their nutriment and support.

Count. Let that method be pursued. I approve of it highly.—Chevalier, do you recollect, pray, the general origin of plants?

Chev. Yes, my Lord; they rise from seeds.

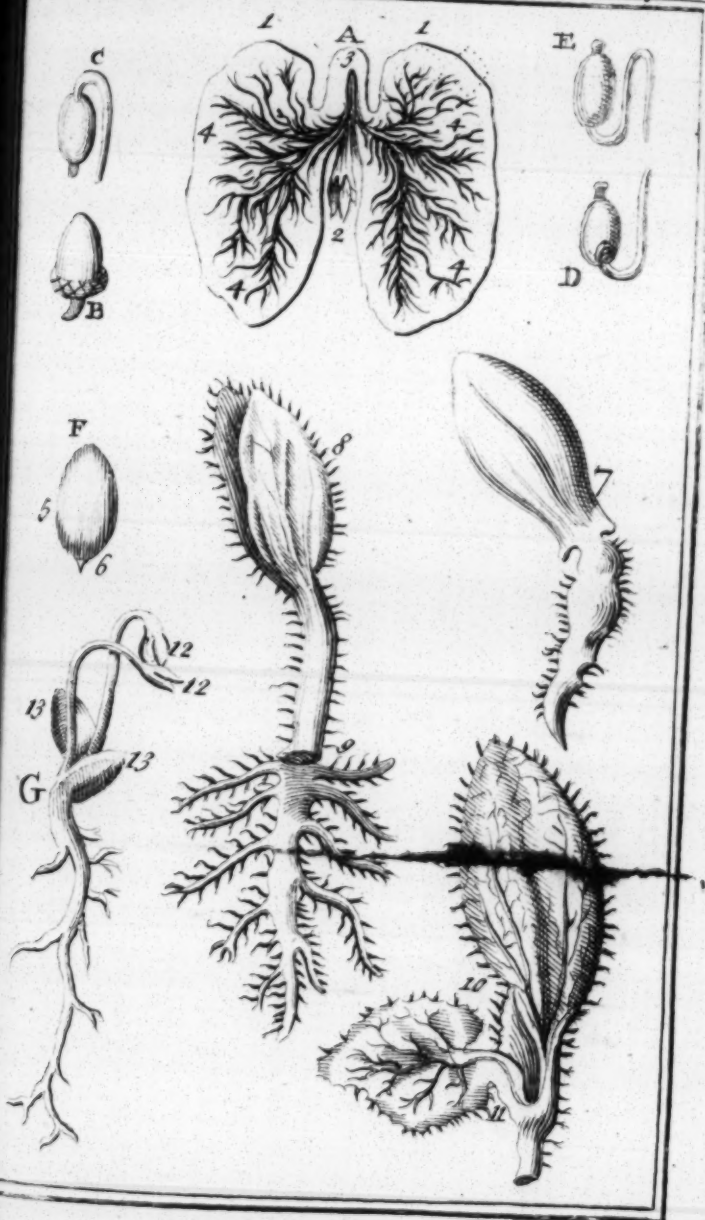
Count. How, Sir! Do you imagine then that the earth cannot, with her heat and juices, produce a plant at once, without the concurrence of some seed?

Chev. No, my lord, not the least blade of grass. I remember you lately observed in your discourse on animals, that tho' the earth furnish'd every individual with its proper aliment, yet she never gave existence to the minutest insect. The same regularity and design that is observable in them, is conspicuous in plants. The earth, with her juices, indeed, may nourish and improve their growth; but, as her power is limited, she can never give them their original existence.

Count. If the juice of the earth could form a plant, it must, doubtless, be endued with all the power of the Creator himself, in order to give immediate being to the roots, the ducts, the fibres, the vessels for the sap, the glands for the filtration of it, the spiracle or air-vents, in short, to every other part of a plant, as the bark, wood, pith, buds, flowers, and fruits. This juice too must have some degree of intelligence, to be qualify'd for such various operations, and never, through mistake, to make one plant produce the buds or fruits of another.

Chev. No one, sure, in his right senses, can ever imagine that the earth is capable of forming the body of a plant. I would as soon assert, that 'twas qualified to give existence to the sun and moon, or to man himself.

Count. I am extremely pleas'd, that you discern the necessity there is of having recourse to the agency of a Supreme Being. He himself, 'tis true, is incomprehensible; but, without his aid and assistance, all things would be unintelligible. His interposition once taken for granted, the production of all things is conceived with ease. He alone had power to form matter itself, and from thence to extract several elements; each of which



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L. Cole, Sculp.

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which is always the same, tho' their different combinations form an infinite variety of bodies. These elements are capable, indeed, of making their approaches to, and intermingling with each other; but then the consequence thereof will be no more than a multiplicity of confused masses, without organs, life, or soul. Was the earth but of yesterday's creation, it would remain, to the utmost duration of time, a naked, barren desert, if the Almighty should not think fit to clothe it, or furnish it with inhabitants. He alone is endued with power sufficient to organize bodies, and give existence to the various species of plants and animals. The least blade of grass, or corn, is formed upon a particular plan, and by a special will, as well as the rest of the creation.

As to the manner of God Almighty's perpetuating the various species of animals and trees, after their first formation, he might either determine within himself to substitute new ones, wherever he saw convenient; in the room of such as grew old or decay'd; or might, by one act of his creating power, provide for all succeeding ages, by inclosing in the seed of the first tree its future posterity in miniature; insomuch, that each species should of necessity produce its own resemblance; and then the earth would be charged with nothing more than a contribution of her juices towards the nutriment and expansion of the shoots: And this indeed is the magnificent order which he has thought proper to establish. The imagination is confounded in the discovery of an infinite number of seeds, wrapped up in one another: But reason dictates to us, that we ought to acquiesce in, and without the least hesitation, assent to what is fact; because nothing is impossible to God.

Prior. Be upon your guard, Chevalier, for I propose to push home. There are some plants, the mushroom and fern, for instance, and several others, in which no seed was ever discover'd, and yet they shoot up every day, and grow in different situations. From whence we must infer, that either God Almighty must create them a-new, or that the juices of the earth, when put into motion, are capable of producing organized bodies.

Chev. Whether his Lordship be a prophet or not, and foreknew some days ago that you would embarrass me with

with your fern, I cannot determine; but he has furnished me with the following answer. He * order'd me to lay my ear close to a piece of white paper, on which at first I could discern nothing at all; but soon afterwards I heard, methought, a rustling, which made me look more attentively upon it; and, at last, I observed a number of small grains leaping over one another, as mites do in a cheese: After this, by the help of a microscope, I found my eyes had deceived me. These imaginary grains were small cods, or shells, which contained in them a large quantity of seed, and, being dry, burst asunder; whereupon the minute grains flew out and almost cover'd the whole surface of the paper. These were fern-seeds, Doctor: And, after this discovery, it will be in vain to tell me that this plant produces no such thing.

Prior. But what say you with respect to the mushroom then?

Chev. With submission, Doctor, I think you bear a little too hard upon me. — However, my answer is this, That there are seeds contained in it, tho' too minute to be discern'd by the naked eye.

Count. You are right, beyond all dispute, if we may form a judgment of the Almighty's conduct, by that which he never swerves from in ten thousand other particulars.

Countess. Every plant arises from a seed. This is a truth confirm'd by experience; but what this seed is and what is contained in it, you, Gentlemen, who have made use of your glasses on this occasion, are best able to determine.

Count. Let us begin then with their external appearance. All seeds of plants have different sheaths or cases wherein they are enclosed till they are lodged in the earth. They are capable of being toss'd to and fro, measured, and thrown into a heap, without the least damage or inconvenience, because they are perfectly covered and secured. Some of them are planted in the very heart of the fruit; as, for instance, the kernels of apples and pears, the substantial parts whereof, are, by consequence, intended to answer two different purposes

is, in the first place, to enclose the seeds, whilst they continue tender, and then to refresh mankind when they want no such covering, and are in their utmost state of perfection. Others grow in pods, or shells; and of this sort are peas, beans, lentils, poppy-seeds, and cocoa-nuts. Some again are placed in wooden shells, which are more or less solid and substantial; such as nuts, filberds, almonds, apricots, peaches, and plums. Others, besides this wooden shell, have a bitter rhind, as walnuts; or a coat surrounded with prickles, to secure the seed from any accidents, till grown to their maturity; and of this species is the chesnut.

Chew. Fruits of but a moderate goodness, I find, have various preservatives; but the peach, which is more delicious than any you have mention'd, ought, in my opinion, to be better secured. We should then have them in plenty for a longer season.

Prior. You are got into your old satirical strain, Sir, I find: But, dear Chevalier, forbear your sarcasms on the operations of the Great Author of Nature; especially since they are as unjust, as they are presumptuous. The peach and plum are allotted for our refreshment, when the excessive heats begin to abate. In any other season they would chill our blood, or at least be less valuable, on account of the variety of other fruits. As therefore their appearance is but of short duration, their apparel is light in proportion: A thin gawse is sufficient. The apple and pear, which are to succeed them, and last all the winter long, are furnish'd with a warmer vestment. Nuts and chesnuts, which are in season all the year round, are still more substantially array'd: The latter are the principal sustenance of whole nations. As therefore the little birds would be tempted to destroy them, whilst in their tender state, nature has secured them from their insults, by arming their external parts with prickles; and by this precaution, perhaps, would intimate, that they are capable of being more advantageous to us than we imagine. The former are the food of many animals, as well as men. Some express an oil from them, that is not only fit for burning, but for the preservation of paintings, and other household-furniture. Our leather-dressers, likewise, consume a considerable quantity

quantity of it. The walnut is delicious even before 'tis ripe; and when brought to our tables, may justly vie with the finest peach. A morsel so agreeable to the taste, would attract all the birds, and deprive us of several conveniencies, did not the bitterness of their rhind deter them from making their attacks.

Count. Besides these external coverings, every seed has its *epidermis*, or skins, wherein the pulp and bud are inclosed.

We may form an idea of all seeds in general, by a pea or bean, or the kernel of a melon; for their texture is much the same. However, as the parts of a bean are larger and more conspicuous, we'll make choice of that in particular, by way of illustration. When a bean has lain four and twenty hours in warm water, take off the cod in which 'tis enclosed, and you'll find it will fall asunder into two † equal parts, which are called the *Leber of the Seed*. At the top of one of them, the bud is planted or sunk in like a stud. This bud is fasten'd to them both by two small bands or tubes. The lobes are no more than a small quantity of meal, intermingled with the nutritious juice, or sap of the earth, which form a kind of pap, or thick lacteous substance: This is filtred, or strained through the two small tubes of the bud; and that is gradually replenish'd with it, and owes its growth and enlargement to it. The two bands are corroborated, and extended on all sides into various branches, which run along the lobes, in order to receive, without intermission, new juices, which are exhausted by slow degrees, for the benefit of the plant.

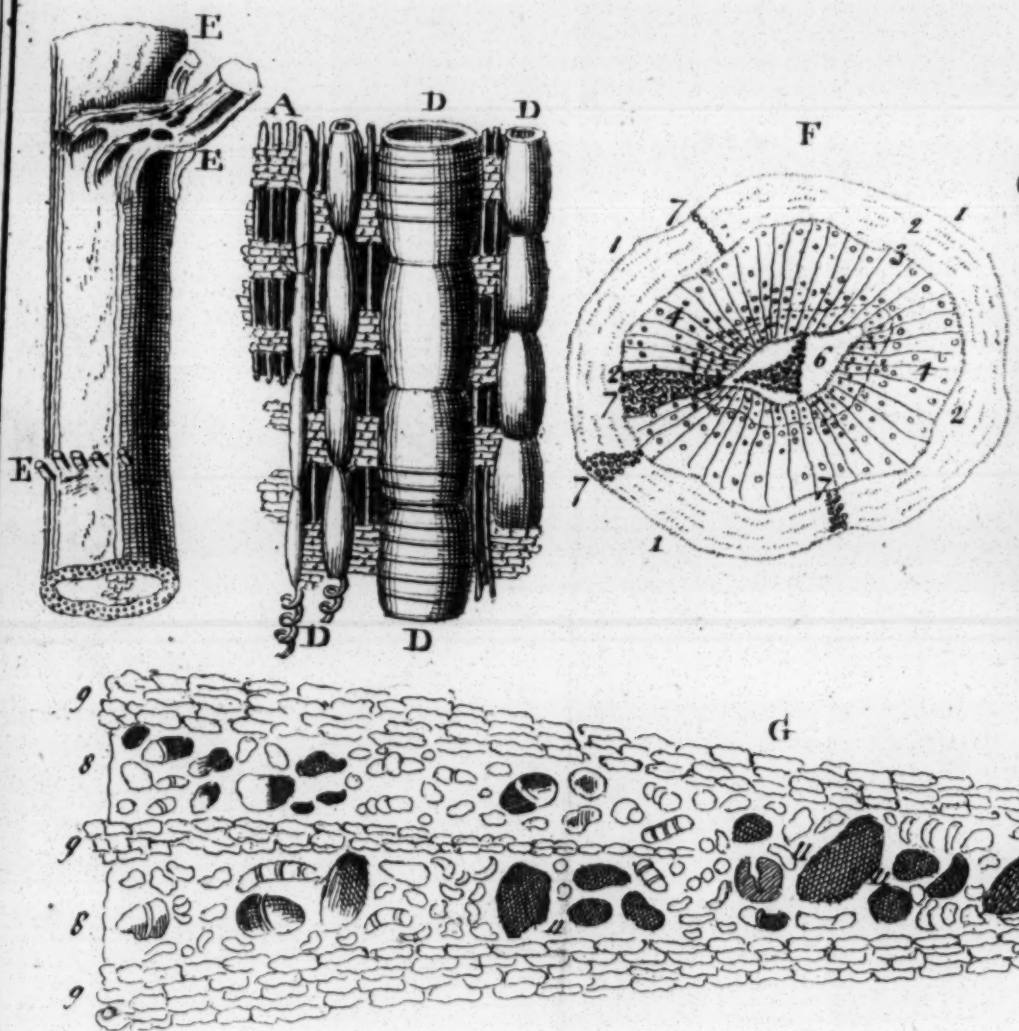
The bag, or at least the fine skin which covers the two lobes, vegetates likewise by imperceptible degrees, and the two extremities of the bag, which surround the head of the bud, expand themselves, and rise with it, in order to preserve it from all such frictions, as may prove injurious to its tender and delicate texture. The bud shoots up in a perpendicular line; but the two extremities of the bag, being of a weaker structure, and not so well nourish'd as the stem, submit by degrees to the impulse of the air, which depresses them on every side, and make them appear of a quite different form from the

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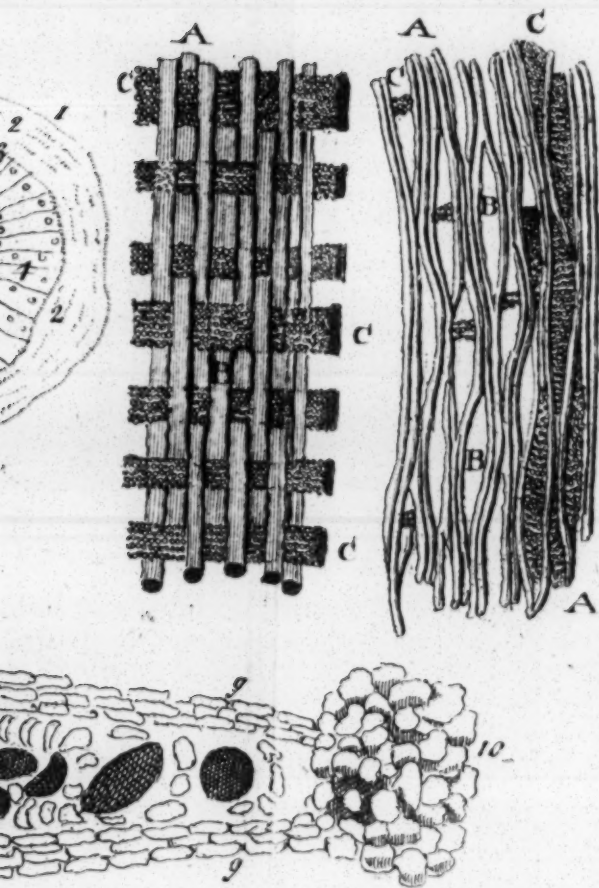
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the true foliage. When the two lobes have communicated all their nourishment to the bud, and begin to wither, the skin which covers them, and the two first leaves, which are only the two extremities of the skin, undergo the same fate. Then the young plant, having received its growth from the nourishment contained in the lobes, and finding from thence no fresh supplies, has immediate recourse to the earth itself for its future subsistence. As to what the bud, which lies at the head of the seed, consists of; and as to the gradual expansion of the plant, I shall refer you to the Prior for farther information.

Prior. The bud of a bean, or any other plant whatever, consists of the root, the stem, and the leaf. The first is the bottom of the plant, and that part which descends into the earth; the second is the body or stalk; and the last the head, or the leaf in miniature, and folded up. 'Tis this that shoots out of the earth, and expands itself by slow degrees.

Countess. With submission, I must interrupt you for a moment. When a husbandman sows, he scatters his corn at random. When a gardener plants beans or peas, he throws them into the ground without observing either the top or the bottom of the seed. Who directs the stem to shoot upwards, or the root to descend and lie buried in the earth?

Prior. However, Madam, this is the conduct which they inviolably observe. The direction of their choice is no ways owing to any intelligence from us. We see, indeed, darkly, that this is the way they ought to bend their course; but 'tis no easy matter to comprehend how this operation is perform'd. Some speculative gentlemen have attempted to find out the cause of this direction, but have not succeeded to their perfect satisfaction. The circulation, however, of the nutritious juice in the plant is sufficient, in my opinion, for the explication of this arrangement.

When this juice, influenced by the heat, flows to the orifice of the vessels in the root, which are all open, it enters in, and beats down, in its passage, the small fibres, or kind of hairs, with which those vessels are invested. This juice makes its progress with ease; but
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can't flow back, because the revulsion of those fibres oppose its return. Thus it proceeds from vessel to vessel, in the body of the stem, in whatever situation it may be. It dilates, improves, and extends it; but finding the resistance of the earth, wherein this stem is still enclosed, it takes its course to those parts, where it meets with the least opposition. If the stem, animated by the juice which runs through it, meets with a hard, compact piece of ground, it struggles a long time for a passage through the plot, being too weak to force its way; and at last either finds an aperture for the reception of air, or else bursts and dies, through its extream delicacy, for want of power to make a farther progress. If, on the other hand, the earth which covers the seed be soft and light, (and 'tis the gardeners * peculiar province to see that it be so) the juice which flows into the stem, finding no obstruction above, makes it shoot upwards into the air; for the nature of motion is to pursue a direct line, unless by some obstruction it be constrained to take an horizontal course. This juice, after its elevation to the head of the plant, is impelled by that which succeeds; insomuch, that it is obliged to evacuate, partly by perspiration, and to descend, partly by circulation. And after its descent through the vessels of the bark, it is again impelled towards the roots by the air, which gains admission by the assistance of the spiracles, or trachian arteries, † with which the bark abounds. The direction of the juice and the air being then towards the earth, they must of necessity plunge the root still deeper into it. The earth, however, obstructing that passage, the root must take a middle course. Impelled below by the direction of the juice, which descends, and intercepted by the earth, which opposes such descent, it finds a passage on one side, and makes its progress thro' the earth in an oblique line, towards those parts where it finds the least resistance. The sap, arrived at the extremities of the roots, to which it administers its nourishment, as well as to all the other parts, and always put in motion by the external air, and the heat of the earth,

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* Hoc imitatur arando. Virg. Georgic. II.

† A trachian artery is a duct or canal, through which the air finds a passage in the bodies of animals and plants.

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has no other course to take, but to wind through the internal ducts of the roots again, and to ascend to the stem, intermingling with new juices, in order to fill the cavities of the vessels.

Count. These are observations, Sir, which I never met with before. The circulation appeared to me dubious; and tho' the true situation of the stem was certain, yet some difficulty attended the explication of it. I perceive however now, by your illustration of the one by the other, that I can form some tolerable idea of them both.

Prior. There are some incontestable facts,* which seem to confirm what I have advanced. When the natives of *Languedoc* graft their olive-trees in the month of *May*, they cut the bark in a circular form, above the scion or graft. If my system be right, the nutritious juice ought always to ascend into the branches, through the vessels, and the pith which lies in the heart of the wood. This juice descending afterwards towards the bark, must drip a little at first out of the wound, then condense in the air, and by degrees become a kind of pad, or protuberance, by which the passages are closed up. The principal return of the sap, which is through the bark, being thus obstructed, the juice must of course flow more plentifully into the branches, which thereupon at first produce a larger quantity both of leaves and fruit. However, as it cannot regularly disperse for want of a free passage, the redundancy of the sap may be such, that it may clog, coagulate, and grow so thick, as not to be capable of flowing either backwards or forwards, and consequently prove destructive to the branches; which was exactly the case of the olive-trees before-mentioned. I'll produce you another very remarkable fact.

An oak, tho' ancient and decay'd, has been known, as I am credibly inform'd, † to discharge some tons of water in a few days, through an aperture made in one of its knots, tho' in the midst of summer, when there was no water near it, and tho' no rain had fell for three months successively. Could this water then be any thing else but the sap, which kept trickling down the bark, and,

* Hist. of the Acad. of Sciences, 1709.

† Act. Erud. Leipf. 1668. p. 204.

and, descending from the branches, discharged itself without intermission at this aperture? As the whole mass of blood in a human body, convey'd from the heart towards the extreme parts by the arteries, returns through the veins to the surface, and afterwards discharges the whole, at the first considerable vein that is open'd.

Count. I know several plants that are very tender, and abound with a lacteous juice, which may serve as a confirmation of what you have advanced. When they are bound very tight with a strong ligament or bandage, towards the middle of the stem, one may perceive, by an attentive observation, that the parts above the bandage swell till they are ready to burst, which cannot possibly proceed from any thing else than the lacteous juice, which rises from the root through the body of the stem to the head, descends afterwards all along the bark, and continues its progress even to the root, unless prevented by such ligament as before-mention'd; as the blood trickles from the internal vessels, or from the arteries in the external ones, called the *veins*, and returns to the heart, unless obstructed by some bandage, where it gathers into a mass, or body, and distends the vessels. But let us hear what the Prior has to offer with respect to the progress of the sap.

Prior. When the root can exhaust nothing more from the lobes, and has drain'd all the pulp, by virtue of some ligaments, or little branches, which it shoots forth there, it extends toward the bottom, and finds, at the extremity of the seed, an aperture, through which it directs its course, in order to find in the adjacent ground a thicker juice indeed, but that which is much more vigorous. The minute plant, tho' till then as white and delicate as the milk, which is extracted from the seed, receiving its sustenance from the earth herself, begins to strengthen, and grow more solid and substantial. When raised to a certain height, it displays, not on the side, but at the top, some part of that which it contains. Tho' 'tis capable indeed of shooting its buds and branches, either at the bottom or the side, yet that is not its usual course; because the sap, impelled towards the top in a perpendicular line, flows with more ease to the buds and branches

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inches at top, than to those on the side: Besides, could the sap take such an indirect course, care would immediately taken to prevent it, that the head might be strong, and the tree stand more upright, and make a better figure.

The external coat, or surface of the stem, hardens in the air; but the air gaining accession to it, by the small pores, or spiracles, which lie along the bark, keeps the pores of it free by an uninterrupted passage, so that they never close. This air, which thus procures admission through the bark, together with a small quantity of nitre and salutary salts, serves to disperse and subtilize the nutritious juice, and make it circulate by an uninterrupted motion. And in order to render the comprehension of this matter more easy and familiar, let these little particles of air, which insinuate themselves into the trachian arteries, or ducts of the bark, be consider'd only as so many small locks of wooll. This wooll is obedient to the touch, and with ease contracted within a small compass; but then it has a spring, or an elastick force; and when returned to its first situation, expands and takes up a much larger space. Just so the air, which enters into the bark, and is lock'd up by the chilness of the night, and by the pressure of the atmosphere, is set at liberty in the morning by the dissipation of the former, and the rarefaction or enlargement of the latter; and, in short, is dilated by the heat, which presses upon it, and separates its parts: But then that air gravitates, in its turn, on the sap whereto it is united; breaks down, and drives every thing before it; makes its excursion wherever it can, and gets admission, by that means, into the branches, the leaves, and fruits; from whence it insinuates itself into the bark; and at last descends, and communicates its pure and perfect nutriment to the roots, as well as to the upper parts. The fall of the leaves, when the air is too sharp and piercing, and their return in the spring, when that element communicates to the sap that motion which it receives from the joint-influence of the sun and herself, are very plain and natural deductions from what has been advanced; and, by-the-bye, this is the very reason why a tree dies after it is buried in the earth up to its branches, or as high

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as the middle of its trunk; for tho' the earth may seem serviceable, by closing the pores of the bark, yet the sap, for want of the impulse of the air, stagnates; and then the tree languishes a-while, and at last expires.

I am of opinion, likewise, that this is the reason why moss proves so injurious to trees. 'Tis reasonable to suppose, that it participates, in some measure, of its sustenance, and is detrimental to it in proportion. However, it cannot, we presume, exhaust the whole. If it contributes therefore towards its dissolution, it must be by stopping up with its little roots, and numberless little branches, all the apertures of the ducts, or canals of the bark; so as that the tree is capable of respiration.

Count. This conjecture of yours seems to be very natural, and well grounded; and it is so great a novelty to me, that for the future, I can assure you, I shall keep a more watchful eye on my gardener, and give him strict charge to remove all the moss from my fruit-trees, wherever he finds it.

Prior. From this passage of the air into the pores of the bark, we may account likewise for that variation which we observe in the colour and smell of succory, cardoon-thistle, celery, and such other plants as are usually bound with strings, or pack'd up in bundles. As the air has no free access to them, it operates on such weak juices as are correspondent with the smallness of their fibres; for which reason, all those sprouting leaves, which are discover'd in the middle of such bundles, advance but slowly; and as they have no power to enlarge their fibres, they are always young and tender, look extremely pale, and have an agreeable flavour.

Chev. I have often ask'd your gardener the reason of this fact: But all the answer I could procure from him, was this; that it was his business to make them up in bundles, and mine to account for the complexion.

Count. What the Prior has observed with respect to the motion of the sap, through the aid and assistance of the air, is confirmed beyond all contradiction, by an experiment which I made some few days ago. I † sow'd some lettuce seed in a bed exposed to the air; and a little quantity of the same seed in another bed, which

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† Transact. Phil. n. 23. Lowthorp's Abridg. vol. 2. p. 206.

ipped into the receiver of my air-pump, from whence extracted all the air immediately. The seed in the former bed rose, in eight days, above an inch and an half; but that in the latter made no appearance at all. Thereupon I let the air into the receiver again, which set the whole into motion; and in less than eight days, the seed shot up above two inches high.

'Tis likewise owing to the power of the air upon the sprout, that the sprouted barley, which is brew'd for my servants, and generally kept in a cellar, turns all its roots towards the air-vent. The air, which always gets admittance at that passage, swells the pores of those roots, and keeps them directed to that quarter.

Prior. From what has been said, it plainly follows, that the sap, which circulates in those plants, ought to be subject to the variations of the air; to stagnate, when the air chills it; to evaporate through the pores of the tree, and leave it in a languid state and condition, in excessive hot weather; to flow more freely than usual, when the air is warm enough to put it in motion, and moist enough, in some measure, to close up the pores, and prevent an excessive perspiration; which is always the case at the opening of the spring, and the close of the summer.

Chev. I think I can now very clearly discover, that 'tis God Almighty himself that has created the buds or shoots, from the beginning; that 'tis the sap of the earth, which unfolds them, and nourishes them by its circulation; and that 'tis the air which influences and affects that circulation.

Count. Let us embarrass the Chevalier once more, and see whether he is stedfast, and sufficiently convinced that the sap can only give nourishment to what is already formed. When the branch of a willow is cut off, put it but into the ground it will take root immediately, and become a complete willow. Thus a branch is actually a tree, and so many branches on one trunk are so many distinct trees. Now I would fain know why the sap, which in the earth can never produce a tree without the aid and assistance of the bud or shoot, can produce such a number of them, when arrived to the top of a trunk, tho' nothing at all be sowed there.

Chew. The sap could never produce them of itself for if so, it would be endued with the wisdom and omnipotence of the Almighty.

Prior. Why then does it drive out in one place a bunch of leaves, in another a bundle of flowers, and always that which is suitable to the plant wherein it is infused?

Chew. As the gardener, Gentlemen, was cutting out trees the other day, he shewed me the difference between such shoots as produce nothing but leaves, and those that bear flowers. The latter are round and large; the former small and taper. One produces neither leaves nor wood: The other, no flowers. All these shoots must be ranged in the tree before the sap can come there. It nourishes, indeed, and sustains what it finds already form'd, but gives existence to nothing. I imagine, Sir, that there are an infinite number of shoots in a tree, some whereof produce the branches and the leaves, and others the flowers and fruits.

Count. That's well observed.

Chew. But here arises a fresh embarrassment. Why don't all these shoots make their appearance at once? Who directs them to make this gradual progression?

Count. We are as much in the dark, 'tis true, with respect to this particular, as to the ovarium of a bird that lays but one egg, or at most but two or three at a time. 'Tis evident, however, that the infinite wisdom and goodness of God is as conspicuous herein, as his omnipotence itself; for he does not only indulge us with a variety of delicious fruits, but makes a reserve of the same species, not only for the year ensuing, but for succeeding ages. Notwithstanding it may reasonably be supposed, that this amazing œconomy is regulated according to the sap's continuance either a longer or shorter time in a state of inaction. When the passages are open and free, it flows without obstruction, and not only supplies the branch that is ready to receive it with a proper degree of humidity, but invigorates it, and afterwards discharges itself through those ducts, or channels, which are assign'd for its return. Should such branch, however, and such tube, through which it flows back to the root, be cut off, its circulation would be stopp'd; it would

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push out at the wound, with much difficulty find out some new passage, and put those shoots in motion which lie nearest the bark, as being most capable of dilatation without resistance. Thus those branches that are re-nched are gradually restored, and our tables from time to time furnished with an inexhaustible source of provisions.

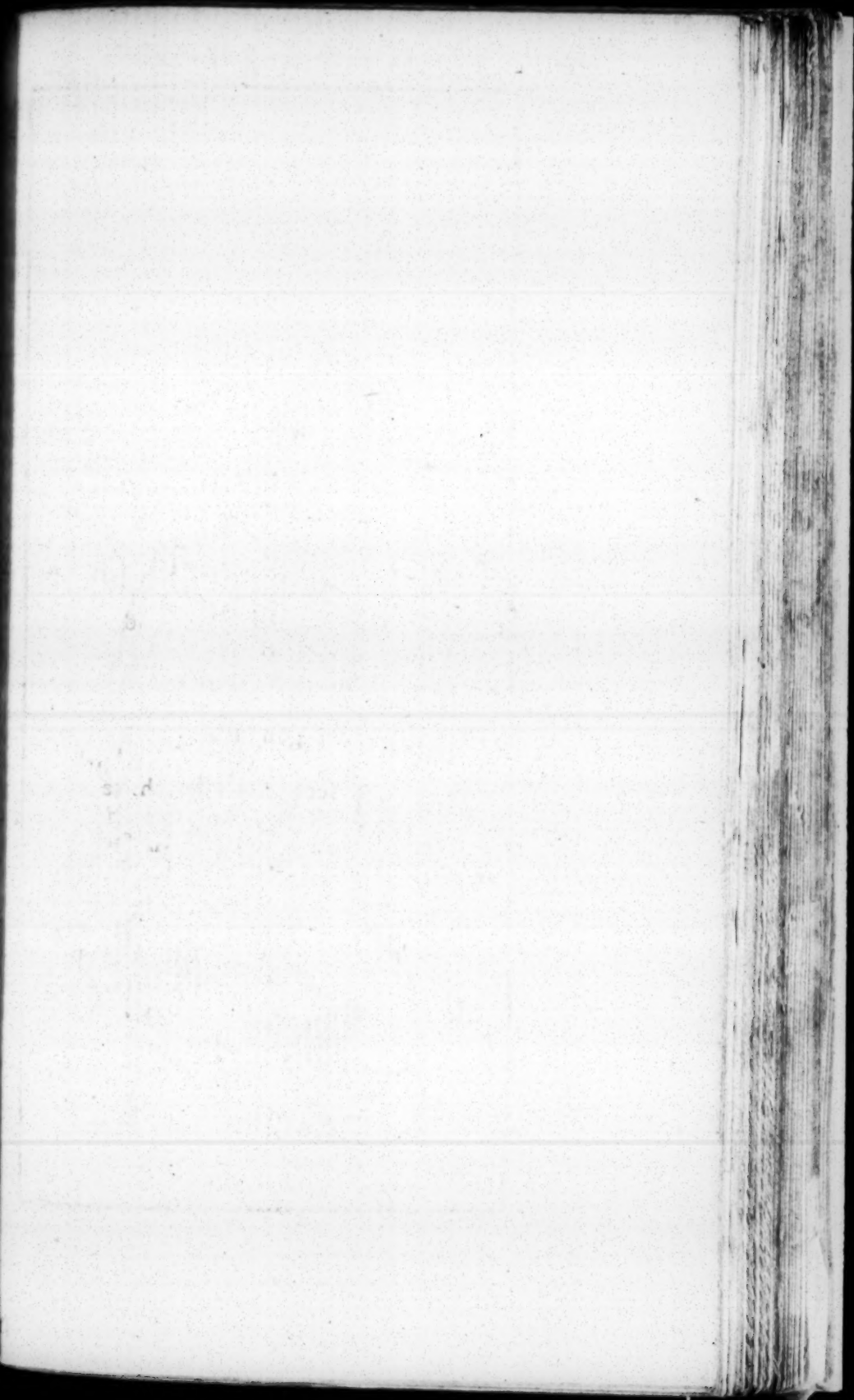
Chew. As one can start no objection, I find, to his Lordship, for which he has not a ready solution, I must beg the favour of his indulgence once more. Our gardener has frequently shewn me the various methods he pursues for the preservation and increase of plants. Some proceed, I find, from seeds only: Others from seeds and onions, or suckers; as tulips, for instance, which have seeds in their pistil, and a large quantity of small onions, which rise, like a numerous progeny, round the large onion, or parent-plant. Some are augmented, and brought to perfection by scions, or grafts; which are no more than small branches of the finest sort, artfully inserted in an aperture made in the wood or bark of some wild, or worthless plant. Others are multiplied by rains and provines. The strawberry plant throws out two long fibres on each side; the knots whereof take root in the earth, and become so many new stems. The branch of a vine, bowed down, and thrust into the earth, shoots out fibres through the knots, that lie buried and concealed. Cut the branch off, where it joins with the stock, and the other end, which rises out of the ground, becomes a new vine. To conclude; there are plants that proceed from little slips, or twigs of trees, when set in the ground, without any other manual operation. I don't see indeed, that any difficulty arises with respect to the two first; because a seed, or a seed and a sucker, contain in them a shoot, or a minute plant complete. The graft, likewise, containing its buds for leaves, as well as fruits, the sap, when it flows into it, not only gives, but discovers, I conceive, what the graft contains: But I cannot rightly account, I confess, for the provines, and slips of trees. The Prior, I remember, inform'd me, that in every bud, there was a root, stem, and head: Now the slip that is planted in the ground has a stem and a head, 'tis true; but I can't see how it has a

root. If the sap be capable of giving roots to trees. Where's the absurdity of asserting, that it can give a stem and a head, leaves and fruits? The root is as important a part, and as well organiz'd as any of the rest.

Count. Now my prophecy is fulfilled. The Cavalier, you see, is become a perfect philosopher. However, I'll remove this stumbling-block immediately. When we set a slip into the ground, the sap which overflows it, puts some of those shoots in motion, which are to produce new branches. The little suckers, which expand themselves on each side, are, by the pressure of the earth upon them, prevented from rising with ease into the air. The juice which ascends into the stem coming afterwards to flow back, and descend upon the same suckers in the earth, take their course downwards instead of upwards, and become roots instead of branches. From whence we may conclude, that the stem gives only a passage to the sap and the air; that the sap and the air give nutriment and motion to all the shoots, but that these shoots are produced before-hand, and are perhaps wrapped up in one another from the beginning of the world, for the benefit and advantage of mankind through the succession of all ages.

Countess. Having thus gone through the regular and beautiful arrangement of shoots, let us enquire a little into the nature of their fecundity; which we may boldly assert, has the air of a perfect prodigy: And if we ought to be affected with the excellency of those gifts which we receive from the Almighty, we ought with an equal sense of his goodness, to express our grateful acknowledgments for that profusion with which he bestows them upon us. It was not his pleasure, that man should be gratify'd only with such or such salutary plants, but that, let what would happen, he should never be without them.

Not long ago we had a very ingenious gentleman amongst us, who attempted to count the seeds contain'd in a single branch of a young elm, that had been planted about twelve years; and forming a judgment of eight other principal branches by the first, and of the produce of an hundred years by that of one, his computation amounted





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mounted to several millions*, and myriads of millions of seeds. His curiosity likewise prompted him still further, to count all the buds he could discover on the new branches in one year. After that, adding them to what would be the produce of one hundred years to come, inclusive of those, which at present lay useless in every part of the tree, where the sap had not rose, he form'd a calculation perfectly surprizing, and made this judicious reflection on the whole: That not only the traces of wisdom and power, but if, without presumption, we may be allowed the expression, those of infinity itself were visibly impressed on all the operations of the Deity.

Prior. These truths are, doubtless, worthy of our highest admiration and regard. They surprize us, 'tis true, because we are confined and circumscribed. 'Tis good for us to have a glimpse, or transient view of them, to make us humble, and conscious of our own insufficiency: We ought not, however, to be too restless in our enquiries after them; because they would prove too great an embarrassment, and inconvenience to us.

Countess. That's true. Let us now cast our eyes on such objects as are somewhat more familiar to us, and yet no less proper to enlarge our ideas, and induce us to reflect with reverence on the Great Author of their being, I mean, our flowers. I always looked upon a flower, as a beautiful work in miniature, ordained by Providence for the entertainment of the eye, by a variety of agreeable colours, and sometimes for the gratification of the smell, by an odorous exhalation. This was all the idea I had then entertain'd of it. My calculator, however, astonish'd me prodigiously, by informing me, that the flower was not only the sheath, † or case of the fruit; but that every individual part of that flower was necessary, to give the fruit its formation and regular shape. The explication, in short, which that great philosopher gave of several other particulars, were so entertaining, that I presume I shall never forget them. We women,

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* Memoirs of the Acad. of Sciences, M. Dodart 1700, and 1701. Nieuweny.

† Transact. Phil. n. 207. Sam. Moreland. Rari Hist. Plant. Memoirs of the Acad. of Sciences, Mr. Geoffry, Jun. 1711.

who have but seldom the benefit of any solid instruction, are frequently much more surpris'd than the men at a new discovery, and retain it with greater ease; because we are not so liable to that confusion which a multiplicity of sciences might possibly create.

There are some flowers, said the gentleman of whom I am speaking, that have a large cap, or cover, such as poppies and carnations. Others have none; as tulips, anemonies, and many more. All of them, however, or the greatest part at least, are furnished with leaves, chives, tops, and pistils. The leaves are a sort of pali-fadoes, with which nature has surrounded the heart of the flower, in order to cover and defend it, as occasion shall require. These flowers blow at the rising of the sun, for the admission of his genial heat, and shut themselves up, some more and some less, at the approach of rain, or the night, for their preservation from the dews, and other inconveniencies. They form, for the generality, a small dome, or arch, which is a kind of screen, or shelter for the seed. By this precaution, they seem to be conscious of the trust reposed in them. This seed, for the generality, is enclosed in one or more pistils, which are so many little cods, or shells placed in the center of the flower. The chives are fibres, or little columns, which rise to the height of the pistils, and support the tops. These tops are a sort of pendants, or hollow shells, filled with a fine resinous powder, which falls into the cup of the flowers, but more particularly on the top of the pistils, whose points are shagged, and full of little holes, for the reception of that fine dust. Those points stop the grains of the powder, and those little apertures render its passage to the seeds more easy: Each orifice is so small, that one single grain of dust will fill it. Were two to pass at once, and both to find admittance into the mouth of the bag which covers the seed, they would create a disorder, and an irregular production: The seed being warmed, opens the top of the little skin that covers it, and receives one grain of powder from the chives: More would be useless. This small grain lies at the entrance, or point of the seed, is a perfect tree, and will display itself in its proper season. The grain of itself is not prolific: She's only the

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purse of that bud; and 'tis so certain that she receives it elsewhere, that were we to pluck off the chives and their tops, as soon as the flower open'd, the flower would appear as beautiful as ever; the grains might possibly grow, but they'd be unprolifick. No bud would be ever found there. This shoot does not spring from the chives, which are only little sprigs, appointed to sustain the tops; but from the fine powders within them, which, when ripe, burst the tops, or little purses which enclose them. They fall as through a sieve, and scatter all about. Some are of opinion, and not without good grounds, that each individual grain of this powder is a shoot, containing in miniature the whole future plant. And I'll produce you some instances, by way of confirmation. Should any immoderate rains in the spring wash these powders away, there would be no hopes of any stock. When the season for the flower proves unequal, and either the rain carries off the buds, or the clamps shut up the apertures of the caskets, wherein the grains are enclosed; as little or none of the powder falls into the caskets, or pistils, the greatest part of the grain remains unprolifick, and the produce is but small. This is found equally true with respect to the flower of the vine, and corn, as well as that of trees, or the minutest plants. But if the season prove favourable, and the powders be ripe, one grain of them only falls down on the aperture of each seed; then they become prolifick, and plenty is the certain consequence. The other grains of that powder, which are numberless, are not totally lost. The bees make wax of them, and whole tribes of insects resort to them, either for their sustenance and support, or such other conveniencies, as we are strangers to. But the spring is the most proper time for our illustration of these things to the Chevalier.

In the tulip, for instance, whose cup turns upwards, the chives rise higher than the pistil, in order that the tops may pulverize it, by only letting fall, or permitting the wind to blow some small quantity of their dust upon it. On the other hand, with regard to the imperial lilly, whose cup turns downwards, the common lilly and the honey-suckle, whose flowers are exceedingly bent; should the pistil prove shorter than the chives, 'tis

plain that those powders would fall from the tops to the ground, and that the seed enclosed in the pistil, would reap no benefit or advantage from it. Whereas, should the bent pistil prove longer than the chives, the powder from the tops will meet as they fall with the extremity of the pistil, and with all the ease imaginable enter into it. And this is the method which nature has observed in the arrangement of her flowers.

Chev. Will your Ladyship favour me so far, as to take this turn sole in your hand, and shew me the several particulars which you have been speaking of?

Countess. With all my heart, Sir. 'Tis a flower no ways unworthy of your regard. I have lately found out, that the structure of it is quite different from all the rest. It contains as many pistils as grains. Let us loosen some of them with a needle. These white grains now, which I have taken from the bottom of the flower, are unprolifick of themselves. On the top of every grain there arises a little cup, in the center whereof there is a kind of brown purse, or cod, full of yellow powder without ascending, as in other flowers, to the chives, which here would be perfectly useless. Through this little bag, there rises a small tube, or stalk, the bottom whereof adheres to, or is united with the grain, and the top is fringed with hair, in order to preserve the powders. This tube likewise opens at the top, for the reception of some grains of these powders, and grows forked. When it has performed its function, the points ascend, and fold over one another. At last they grow dry and useless.

There are some plants that have no other flowers but their own proper fruits; as for instance, the fig-tree, where all the kernels contained in it are encumbered and accompanied with their chives, tops, and powders.

Again, there are other plants, that produce two sorts of flowers upon the same stem, as pompions and melons. Such flowers as contain the fruit, are distinguished by gardeners under the denomination of *real flowers*; and those whose powders are enclosed in a purse that is planted in the center of them, and from whence these powders fall through three or four visible apertures, are called *false ones*. The latter are frequently plucked off

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which is a judicious practice enough, when the produce is secure, and the melons are duly form'd; for by this retrenchment the sap is preserved: But 'tis imprudence to the last degree to destroy these false flowers at their first appearance, because they contain the prolific powders, without which those which would produce fruit, would be barren and useless. And one of our gardeners confirmed this fact by being too officious, and too hasty and unskillful in his retrenchments.

The gentleman before-mentioned made this further remark, that not only the pompion, but several other plants had two kinds of flowers on the same stem; and during his stay with us, demonstrated the truth of his assertions, in regard to the oak, the walnut, the hazel, the ivy, the mulberry, and the plane-tree.

He some time afterwards assured us, that some plants produced their fruit flowers upon one stem, and their chive-flowers on another: As for instance, the palm and the linden-tree, spinnage, nettles, hops, and divers others.

Chew. Tho' I am charmed with every article of your Ladyship's discourse, yet I still find it difficult to conceive, how the seed should be upon one stem, and the flowers or powders only on another.

Countess. As this is a fact obvious to our daily observation, you must not be too incredulous.

Chew. Why then should we smile at those persons who assert, that there are male and female plants?

Countess. Let us step but cross the bridge to those hemp gatherers yonder, and one instance will demonstrate the reality of the rest. Here are two kinds of hemp; one, whose flowers are dried, and this is what has been gathered some considerable time; the other is still green; and if you observe, you'll find under the leaves some bunches of seed. The flower stalk was at first the tallest, in order that the powders, falling from the flowers, might be received by the seeds on the other species, which were then much lower. The flower-stems, having performed their office, are decayed; and they are taken away and separated from the others, to keep the people in employment till the fruit-stems are ready to be gathered. The latter, you see, are still perfectly green;

they'll still rise higher, and grow stronger before they're ripe.

Chew. I readily acknowledge, your Ladyship has made a convert of me.

Countess. Now, Sir, speak freely. Which of these two species would you call the male, and which the female?

Chew. The first, whose flower-stem is at present the shortest, and already wither'd and decay'd, I should call the male; the other, I should call the female; and, in my opinion, it must be so.

Countess. I find you are for calling things by their proper names; but the good country-women have thought fit to dissent from you; and for no other reason, but because the thread they spin from the former, is more fine, close, and strong. When you come amongst them, you must talk as they do, or they'll never understand you. But a philosopher, the Chevalier I mean, may think as he pleases.

Chew. To confess ingenuously, Madam, and to convince you of the depth of my philosophy, I have no idea of the use of this plant, neither can I discern any resemblance between this, and that which I have seen spun, and manufactur'd into cloth. Will your Ladyship indulge me so far, as to explain this to me.

Countess. Gentlemen, I invite you to entertain the Chevalier to-morrow with what exotic plants you please, and to search all *Asia* and *America* for such as are most curious. For my part, I don't propose to go a mile from my garden; and yet 'tis possible that I may produce something preferable to any plants your foreigners can boast of; and that too shall be nothing but hemp. I shall reserve that plant for my subject; and our conversation, if you please, shall once more turn upon distaffs.

PLANTS.

DIALOGUE XV.

The Count and Countess, the Prior, and the Chevalier.

Countess. **W**ithout a compliment, Chevalier, I am heartily concern'd at the sudden notice you have given us of your intended departure. I was in great hopes of having your good company till September; but as I am sensible the affairs of your family require your immediate attendance, I cannot urge your stay. We must now take our farewell of fishing, hunting, and the new academy.

Chev. The last article, Madam, gives me the greatest pain. Hunting and fishing are recreations to be met with in any place; but the enjoyment of such conversation, so instructive, so . . .

Count. Now, my dear Chevalier, we are indulging the ceremonious strain. We should admit of no compliments in our academy.

Countess. 'Tis very well, my Dear, you are making regulations, when our assembly is just breaking up, and drawing towards a conclusion.

Count. No, no, Madam, 'tis rather, as I take it, in its infancy, and that 'twill be annually renew'd in September. Pray, my dear Chevalier, what's your opinion of the matter.

Chev. I am apprehensive, my Lord, but of one inconvenience; and that is, I shall be wishing eleven months together for that same September.

Count. I know your temper so well, that I don't in the least doubt but you'll do every thing in the most elegant

gant manner, and like a man of true taste. That kind of literature to which you are now going to apply yourself is not only as useful, but as entertaining likewise as natural history; which at present you have no need to be instructed in; and I would only recommend it to you as an innocent amusement at your stated vacations. However, the Prior and I will settle and adjust in your absence the subjects of our future conferences. I shall submit the choice of them entirely to him, and we may both with safety rely upon his judgment.

Chev. How happy are we in the country! Indeed we might be so in town could we but

Prior. Let us act more conformably to the rules of our society. No more compliments, I beseech you, Gentlemen. Academicks, as we pretend to be, never meet to flatter and cajole one another. We are at this time assembled to attend my Lady's lecture, according to her own appointment.

Countess. You must permit the Chevalier to give us this testimony of his obliging temper. You needn't be in such a hurry for the entertainment I promised you; since 'tis nothing more than hemp and thread.

Prior. And for my part, I don't think those subjects any ways trivial. We had much better be acquainted with such things as are of daily use to us, than be inform'd of what passes in Jupiter or the Moon. We don't always reap the greatest advantage from such speculations as are most sublime, from making enquiries into such matters as are entirely foreign to us. I am much better pleas'd with Mr. *Reaumur*, when he is labouring to destroy the moths in our hangings, and the bugs, and other vermin that infect our houses, by the use of oil of turpentine, and the smoak of tobacco, than I am with Mr. *Bernoulli*, envelop'd, as it were, in his Algebra, or Mr. *Leibnitz*, intent on combining the several advantages and inconveniences of possible worlds. We may be rational creatures, and have a sufficient share of learning too, without running a thousand leagues from home. That philosophy, I take it, is the best, that is, the most plain and intelligible: We cannot possibly employ our time better than in the contemplation of such objects as surround us, and in which our own interests are immediately concerned.

Countess. Isn't the Prior very obliging, Chevalier, to give what I have to offer, on these heads, an air of philosophy, and important learning, when all my observations are borrow'd from illiterate peasants, who in things of this nature are our masters. I'll undertake the task, however; but remember, Sir, 'tis only intended as an innocent amusement.

Flax may be rank'd in the same class with hemp, and altho' it be much shorter, and abundantly finer, 'tis of the same nature, and employ'd in more beautiful manufactures. As soon as these plants are gathered, their stems or stalks are first expos'd to the sun, in order to ripen the seeds; and then thresh'd. After that, those stems are tied up in bundles, which, when fastened to poles, are left to steep in some clear standing water for fourteen or fifteen days successively. The substantial part of the stems being by that time almost rotten, those bundles are taken out, and well dried. Flax, indeed, instead of being well penetrated that way, is, for the generality, expos'd to the damps of the night, and the heat of the sun alternately, in order to give it a finer gloss. When the flax and hemp are thus duly soak'd, and perfectly dried, they are bruised by handfuls on a block, with a kind of mallet. All the bullen, that is, the internal substance of the stalk, flies off in chivers, by the force of the blows, and nothing remains in the manufacturer's hand, but the thin bark, dissolv'd in large threads through the whole length of the stem. This thread is afterwards hung upon a perpendicular board, and well bruised with a beetle, in order to shake out all the minute straws which may possibly remain in the bullen. All the substantial or gross parts of the stalk are now scatter'd and dispersed. The threads too of the bark, which remain in the workman's hand, are extremely fine: However, they receive their perfection from the comb; that is to say, they are first drawn through large cards, or iron teeth, and then through such as are still finer, in order to take from them whatever may be too thick and gross. This refuse is what we generally call tow, of which not only matches are made for the artillery, but a thick yarn for packing-cloths, which are used by all merchants in general both at home and abroad.

The hemp, thus duly prepar'd, is either tied up in parcels, in order to be sent to the rope-yards, or in twists, if it be fine enough for the spinster, or the weaver. Thus are we come at last to the distaff and the spindle. — You smile, Gentlemen, but I'll convince you that what you thus despise is a very valuable commodity. Suppose now you were three *Americans*, natives of *China*, or any other remote country, no matter what, and just arriv'd in *France* (excuse my freedom in making the supposition) how would you stand astonished when I assur'd you that we have a little plant, whose fruit is the favourite aliment of several species of birds; that of the same seed we make a kind of bread for the improvement and fattening of our cattle, and an oil, which by numberless families is used instead of candles in the night-time; that our women, for the generality, and not our men, manufacture the bark of this plant, and furnish our trading-vessels with those wide-spreading sails, by the help of which our most valuable commodities are exported, and others in their room convey'd to us from the most distant parts; that this bark is work'd into cables, strong enough to bear the weight of the heaviest anchors; and that ropes, girths, and packthread, are likewise composed of the same materials; all which are of universal and constant use in almost every affair of life, both publick and private; that of this very bark are made tents for the accommodation of our soldiers, and the finest linnen for the decoration of our tables; that 'tis converted likewise into a dress which is of singular service both night and day; is perfectly neat and decent; and not only contributes as much to the preservation of our health as any bagnio whatever, but is substituted in its room with equal success, without the embarrassment and fatigue of it; that this bark, in short, according to the various forms in which it appears, through the manual operations of our *European* women, becomes either the costly and ornamental garb of kings and princes, or a decent, cheap attire for the shepherd and the ploughman. These are some of the numberless benefits and advantages arising to us from this single plant.

Now, Gentlemen, what think you? Are not we a happy people, when our women are thus expert at the

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spindle and the distaff, and are capable of turning this bark to such an incredible advantage?

Prior. Give me leave, in my turn, Madam, to suppose myself an *Iroquois*, and ambitious of maintaining the honour of my native country. You are lavish, I find, in your encomiums upon hemp. I own, Madam, 'tis an excellent plant; but then we have three † several trees, that can boast of equal, if not superior virtues. One creeps along the ground, like a vine; the second is thick, like one that grows with a bush-head; and the third is as tall as an oak. Each of them, after it has produced very beautiful flowers, is loaded with a fruit as large as a walnut, the coat or surface whereof is perfectly black. This fruit, when ripe, blows, and discovers a down extremely white; and this we call cotton. The seeds are separated from it by the aid of a hand-mill. After this, 'tis spun and manufactured into various fine works; such as stockings, waistcoats, quilts, tapestry hangings, curtains, and several other sorts of household-furniture. Of this likewise are made the ladies muslins. There is sometimes wool, silk, and gold itself intermingled with it. After this impartial account of it, I hope your Ladyship will entertain no contemptible idea of *America*.

Countess. I am pleased with this production of hers: But do your natives manufacture it? Are not you obliged to us *Europeans* for bringing it to that perfection you boast of?

Count. Since the *Prior*, in the character of an *Iroquois*, has taken upon him to be an advocate for the *American* cotton, I'll venture to personate a *Chinese*, and in the first place, to plead the cause of the cotton gathered in *Asia*, which is manufactured there in a more beautiful manner than in any part of *Europe*; and in the next, to give a particular detail of our aloe, which is far superior to any *European* plant that can be named. This ‡, therefore, must not be confounded with that, which is exposed to view, by way of ornament, in most of your druggists shops, is so remarkably slow in opening its flowers, and produces not only long and pointed leaves, but, as you pretend, a kind of silk. Our aloe is as tall

† Savari.

‡ Diction. Savari. Pomet, Hist. of Drugs.

tall as the olive-tree, and much of the same shape. There are three sorts of wood contained under its bark: The first is black, compact, and heavy; the second swarthy, and as light as touchwood; the third, which lies near the heart, diffuses a very strong and fragrant flavour.

The first is known by the name of *Eagle-wood*, and is a very scarce commodity; the second, *Calembouc-wood*, which is transported into your *European* countries, where 'tis highly esteem'd as a most excellent drug. It burns like wax, and, when thrown into the fire, has an aromatic odour. The third, which is the heart, and called *Calambac*, or *Tambac-wood*, is a more valuable commodity in the *Indies* than gold itself. 'Tis made use of for perfuming the clothes, or the apartments of persons of distinction; and is a specifick medicine for such as are afflicted either with fainting fits, or with the palsy. The *Indians*, likewise, set their most costly jewels in this wood. These, however, are not all the advantages of our aloe. The leaves of this tree are sometimes used instead of slates, for covering of our houses; they are likewise manufactured into dishes and plates; and, when well dried, are fit to be brought to table. If stripp'd betimes of their nerves and fibres, they are used as your hemp, and manufactured into a thread. Of the points, with which the branches abound, are made nails, darts, and awls. The *Indians* pierce holes in their ears with the last, when they propose to honour the devil with some peculiar testimonies of their devotion. If any orifice, or aperture, be made in this tree, by cutting off any of its buds, a sweet vinous juice diffuses in abundance from the wound, which proves an agreeable liquor at first to drink, and in process of time becomes an excellent vinegar. The wood of the branches is very agreeable to the taste, and has something of the flavour of a candied citron. The roots themselves are of some service, and frequently converted into ropes. To conclude, a whole family may subsist on, reside in, and be decently clothed by one of our aloes.

Countess. This is a very valuable tree, I confess, and happy is the man who has one of them in his possession; since

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since history informs us, that there are very few of the species to be met with. But be that as it will, I'll venture to assert, that should all the aloes and cocoa-trees that are in the *Indies*, whereof such incredible stories are related, be joined together, the whole, in point of value, will be a mere trifle, in comparison to our hemp; since those trees come to perfection but very slowly, and will not grow in every soil: Add to this, that they must be destroyed before they can be manufactured. Whereas hemp will thrive in any ground: And as 'tis sown and gathered annually, it is not only valuable for its good qualities, but for the inexhaustible stores we have of it; which makes it the delight of the rich, and refuge of the poor.

Prior. It must be acknowledged, that her Ladyship has pitch'd upon a plant, which, tho' not calculated to attract the eye, or excite the curiosity, is of more universal use to mankind than any other plant, corn only excepted, that nature ever produced.

Countess. Let's hear, pray, Chevalier, the plant which you declare for. 'Tis no great matter whether it be foreign or domestick. You philosophers are natives of all nations.

Chev. The sugar-cane †, Madam, is my favourite plant.

Countess. You have made, Sir, a very judicious choice. This plant, tho' we have no such thing, is the wealth of the country where it grows, and supplies those to whom it is imported with a thousand conveniences.

Chev. But I would fain know, Madam, the form of it, and how that luscious juice is extracted.

Countess. To be ingenuous, Sir, those are circumstances which I am wholly unacquainted with. However, our *American* here, no doubt, can entertain you with several curiosities in relation to them.

Prior. Sugar, Sir, is no more, properly speaking, than the salt which is found in the juice, or pith of a reed, very much cultivated in the *East-Indies*, but considerably more in the islands of *America*.

A sugar.

† Savari,

A sugar-cane when buried in a furrow of earth; shoots out from each of its knots, another cane, which, when advanced about five or six feet high, produces a bunch of leaves, much like our flags; and a stem or sprig, terminating in a tuft, as one of our common reeds. Ours, indeed, are of little or no service, except in being sometimes converted into commodious distaffs; whereas the sugar-cane is replenish'd with a delicious syrup. These tubes or stalks are bruised under the beam of a mill, by the hard labour of those unhappy wretches, whom our merchants, tho' they profess themselves Christians, purchase at markets as horses, or any other cattle, at *Senegal*, or in the dominions of *Guinea* and *Angola*. After this, the juice is boiled five times successively in different coppers, or large cauldrons, by which various operations, the essential salt is separated from the syrup. Formerly, the manufacturers of this sugar only began this separation, and then sent it from the *Indies* to *Rouen*, *Orleans*, and several other places, to be wrought to perfection. But 'tis now transported from thence to us in loaves, sufficiently purified and refined. This, Sir, is the origin of sugar, which the moderns prefer, without hesitation, to honey itself, tho' so admired by the ancients. We are now under no concern with respect to the various and unhappy accidents which too frequently attend the labours of the bees. The islands and extensive regions in the heart of the torrid zone, are covered with a harvest of these canes, from whence the syrup is extracted first, and the essential luscious salt, which at this time is of such universal use not only in preserving what will not otherwise keep, but in seasoning what would either be insipid without it, too poignant with our common salt, or, by its natural bitterness, too unpleasant to the taste.

Chev. I am surprised to hear that salt should be extracted from a plant.

Prior. All plants and bodies, Sir, have their salts. When our alchymists resolve any body whatever, by their fires, they always find a greater or lesser quantity of salt in what remains after the distillation. The ashes which fall from the wood we burn, are nothing more than

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than the earthy parts, and the salt of the plant which was laid upon the fire.

Countess. The salts then, I presume, which thus lie latent in the ashes made use of by our washerwomen in their lye, contribute very much towards the blanching of our linen.

Count. I beg, my dear, we may have no farther discourse about salts or lye till the next year. As our time is so short, let us keep close to our subject, and take a cursory view of those plants in particular, (since 'tis impossible to treat of them all) which are best known, and are most beneficial.

Chev. There are no medicinal plants, I believe, more efficacious than *Manna*, *Rhubarb*, *Ipecacuanha*, and *Quinquina*. I know their virtues indeed, by experience, to my cost. However, I am a perfect stranger to the country, from whence we have them.

Count. *Manna* * is a sugar, or species of natural honey, that flows from the leaves of the ash-tree, with which *Calabria*, situate at the extremity of *Italy*, abounds. Fluxions of this nature are very frequent. In the spring, our linden and poplar trees are perfectly covered with a glutinous fluid, which perspires through the pores of their sprouting leaves, and diffuses a most delicious odour. The agreeableness of it seems to promise something beneficial, and perhaps experience may in time induce us to make use of it. There are some imagine, and I wish the notion was more universally received, that God Almighty has indulged every country with proper medicines for such distempers as are peculiar to, and prevail most in it; and that there are numberless plants all round about us which freely tender us their service, and, were we more attentive and less impatient, would prevent our having recourse to foreign remedies, which are always very expensive, often useless through age, and sometimes not only adulterated, but converted into poison, by the avarice of those who import them. It must be allowed, however, that none are better than those the Chevalier has mentioned, nor any that have met with more universal success.

Rhubarb

* Savari Diction. Pomet's Hist. of Drugs.

Rhubarb is the root of a small tree which grows nowhere but in *Asia*. The *American* rhubarb, which some imagine to be of the same species, has not as yet been proved to be so, to the satisfaction of the judicious.

Ipecacuanha is the root of a small tree which is the peculiar produce of *Brazil*.

Quinquina is the bark of a tree that grows principally in *Peru*. In many countries it bears the name of *Jesuits Bark*; because a learned member of the society of *Jesus* first found out that specifick medicine. Dr. *Talbot*, a celebrated *English* physician, has, by his judicious preparation of it, rendered it still more advantageous, and more universally known. The bark of a tree in *Cayenne*, called *Simaraube* *, is now much in vogue; and, as we are credibly informed, infallibly suppresses the most inveterate dysenteries.

These remedies, so efficacious, and so highly esteem'd, are nothing more than the roots and barks of some particular plants. After the proper juice which they are capable of containing, we can entertain no idea of any thing more than minute vessels, filaments and vent-holes; that is to say, a set of vessels intended for the filtration or passage of the most subtile juices. These barks and roots, when once reduced to powders and taken inwardly, are only, in my opinion, like a parcel of fine sponges, whose pores and orifices are proportioned to the extreme minuteness of the acids which discompose and effect the patient. Those acids insinuating themselves, or more properly speaking, sheathing themselves in the sponges, sufficiently open'd to receive them, and yet close and compact enough to retain them; the acids, sponges and the malady are all carried off, and gradually dispersed. This first conjecture, which carries with it, at least, an air of probability, inclines me to suspect, that we might probably find a root or bark, much nearer home, that would answer the same ends.

Prior. I agree with your Lordship entirely. Our gentian root is as infallible a cure for an intermitting fever, as the jesuits bark.

* *Memoirs of the Acad. of Sciences, 1729. Mr. Jussieu.*

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† Ibid.

† Ibid.

• Savari

Count. 'Tis to be hoped that some few experiments more will make us sensible of our own riches.

Countess. Gentlemen, you treat of physick, 'tis true, in a very rational manner; but there are other plants still more in vogue, and much more agreeable to the taste, I mean coffee, tea, and chocolate. I should be glad to know from whence we have them.

Count. Tea † is nothing more than a leaf of a tree that grows no where but in *China*. When the leaves of this plant are infused in warm water, and the bitterness of them is a little corrected by the application of a small quantity of sugar, they diffuse the flavour of a violet, and a volatility, which in some measure is a refreshment to the brain: And if we allow it to be an *aperient*, I believe we have mentioned all the good qualities it can boast of.

Coffee ‡ is a small berry gathered from a tree in *Arabia Felix*, towards *Aden* and *Mocha*. It has been cultivated likewise lately with some success in the parts adjacent to *Batavia*, about *Madagascar*, and in the isle of *Bourbon* belonging to the *French*. This berry is first roasted, and then ground to a fine powder. When infused in warm water, it has a fine flavour, and tho' a bitter, yet a very agreeable taste. If used with moderation, it purifies the blood, and refreshes the brain: But if drank too freely, and too often, it disorders the whole animal system, and robs its admirers of their rest. There is no room, however, for our being surpris'd at these pernicious effects of it, since there are an infinite number of fiery particles added to the natural volatility of the berry, after it is roasted; and those particles, when swallowed with the grounds, must influence and effect the blood, in proportion to the quantity that is drank.

Chocolate, which is dissolved in warm water, in order to make a very refreshing liquor, is a paste; the principal ingredient whereof is the powder of cocoa-nuts *, which are extracted from a long cod, or shell, much like a cucumber. These nuts are made up with some particular drugs. The *Mexicans*, whose country abounds

† Ibid.

‡ Ibid.

* Savari.

abounds with these cocoa-trees, take the nuts, and mix them with *Indian* corn, and such sugar as is extracted from their own canes; together with a small quantity of *Rocou* seeds, the colour whereof is the finest vermillion in the world. All these ingredients are ground together between two stones, and work'd up into little cakes, which are eaten dry when they are hungry, but dissolv'd in warm water when they would quench their thirst.

The *Spaniards*, who find this composition very advantageous and agreeable, and a commodity that never hangs upon their hands, take so much care to bring it to perfection, and to enhance the value of it, that at this very day, a garden of but a moderate extent, is worth to the proprietor near twenty thousand crowns. Some charge the *Spaniards* with mingling a large quantity of cloves and cinnamon, and an infinite number of other drugs, with their cocoa-nuts. The *French* grocers, however, make very little use of any of those ingredients, and much less of musk and ambergrease, which some people are fond of to infatuation. They only make choice of the best nuts, which are called the *Caracca*, and mix with them a small quantity of cinnamon, the freshest vanilla, and some fine sugar, but seldom any cloves: And they have now attained the art of making such chocolate as is universally admired. There are several counterfeits notwithstanding, abroad, and too many are shamefully imposed upon by those hawkers who vend it clandestinely in private families.

Chev. For my part, I know nothing of the vanilla, and am almost as much a stranger to cinnamon and cloves.

Count. Vanilla is a cod, or shell full of mellifluous juice and little black seeds, whose flavour is highly agreeable. 'Tis gather'd in *America*, but more particularly in *New Spain*, from a tree which bears that name.

Cinnamon * is the bark of a tree which grows only in the island of *Ceylon*. The *Dutch* have destroy'd it in all other places, in order to monopolize the trade. When the fruit of the cinnamon is boil'd in water it diffuses

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(a) Ibid.

an oil, † which coagulates, and grows hard, like tallow, by slow degrees, as the water cools. The candles which are made of this oil are so exceeding white and beautiful, that the natives of *Ceylon* reserve them for the king's use. The cinnamon of *St. Domingo* and the *Antilles* is white, indeed, but not much valued or regarded.

The clove ‡ is a small aromatick fruit, like a nail, that has a point, and a head divided into four distinct quarters. It grows on the clove-tree in the island of *Ternate* *. This spice, or drug, was formerly very common all over the *Moluccos*, and all nations supplied themselves with what quantities they thought proper, without reserve or molestation: But the *Dutch*, who are indefatigable, and are deterred by no obstacles whatever, have either prevailed on the natives of these islands through fair promises, or compelled them through fear of hostilities, to destroy all the clove-trees, except those in *Ternate*, where all the inhabitants in general are devoted to their interest. They are masters likewise of the best settlements in those islands, where the principal commodities are pepper, (a) nutmegs, and mace; which last, tho' nothing more than the shell of the nutmeg, is much more valued and esteemed than the nut itself. Thus, you see, the *Dutch*, by their indefatigable industry, as before observed, and their good œconomy, have secured this kind of traffick entirely in their own hands. And thus have I given you a transient idea of the rise of our modish infusions, and our choicest spices.

Countess. There are two articles, notwithstanding, that much displease me, in regard to these *Turkish* and *Indian* liquors, which are so universally received amongst us: One is, the necessity we lie under of preparing them before they be used; and the other is, the difficulty that attends the preservation of the proper ingredients. All of them evaporate, and lose so much of their flavour, that we are obliged almost every day to renew our stocks.

Count.

† *Literary Journal*, 1683, Jan. 11.

‡ *Savari*.

* A small island on the western part of *Gilalo* in the *Moluccos*.

(a) *Ibid.*

Count. On the contrary, 'tis an advantage peculiar to our best liquors, that they not only retain their virtues many years, but are improved by age. Our Burgundy has been transported even to *Persia* with success. *Tavernier* once made a present of some chests of it to the *Sophy*, which proved so excellent, that his own rich wine of *Chiras* was allow'd to be inferior to it. Champagne, which Monsieur *Evremond*, who was a man of indisputable taste, and one devoted to his pleasures, called the best wine in the universe, will keep good nine or ten years in bottles, and, if artfully managed, many more.

Prior. If our European liquors will keep good much longer than those in *Asia*, so will our corn, if set in competition with the root of the *Meguaa*, of which the natives of *America* make their bread, or cakes; or the pith of *Sago*, made use of for the same purpose all over the *Moluccoes*; or, in short, with all the plants which have been substituted in the room of corn, in all foreign countries whatsoever. 'Tis a duty incumbent on us to express our gratitude to the Supreme Being, for bestowing upon us, in particular, an aliment which is so perfect and substantial in its nature, is procured at such a moderate expence, and preserved with so much ease. Such as are judges in the management of corn assure us, that 'twill keep good an hundred years, or more, if occasion require.

Chev. An hundred years, Doctor! I have known corn grow good for nothing in less than three.

Count. The factor * who proposes to preserve his stock, shifts it once, if not oftener, in fifteen days, for six months successively: After this he spreads it again, once in a month, or six weeks at farthest. He removes it thus from one place to another with a shovel, in order that not only the dust, and other impurities, may be taken from it, but that the air, before too much confined, may be dissipated and dispersed. When his corn, by this method of procedure, has discharged all its fiery particles, it will keep good a whole century, if he pleases, in case his granary be not too low and close, and his floors be perfectly dry. In order, therefore, that the

* Memoirs of the Acad. of Sciences, 1708.

air may have no malignant influence over it, nor the vermin the least access to it, who, if not timely prevented, will multiply almost to infinity amongst it, and each of them sink a commodious cell for its reception in every grain, 'tis customary to spread some small quantity of unslack'd lime over the whole mass or stock of corn; and after that to sprinkle it with water, but not too profusely. The fiery particles contained in this calcined stone fly out of the apertures made by the water. The lime melts, and turns to a white jelly: It then insinuates itself through the whole surface of the corn, about five or six inches deep. Of these grains, and this jelly, thus duly intermix'd, is form'd a crust, which hinders the corn from either taking air, over-heating, or shooting forth.

Prior. In the year * 1707, a magazine of corn was open'd in the castle, or fortress of *Mentz*, which had been lodg'd there in the year 1578; and the bread which was made of it proved exceeding good. When the *Abbé de Louvais* travelled to the frontiers of *Champagne*, those who attended to shew him the curiosities of the country, conducted him to a magazine of corn in the castle of *Sedan*, which had been stored up there above an hundred and ten years; and altho' some of it at first shot up above a foot, by reason of the dampness of the place, yet the greater part of the heap was preserved, made up into loaves, sent to court, and approved of beyond expectation.

Chev. If this be fact, we need be under no apprehensions of a famine. When we have a plentiful harvest, we may lodge in our magazines as large a quantity of corn as we think proper; and then, in case a year of scarcity should ensue, we should lie under no obligation of applying to foreign countries, and giving an exorbitant price for the purchase of it.

Count. The *Dutch* are so wary and circumspect in this particular, as never to be without a double portion. Tho' an attempt of that nature might seem ridiculous in such a country as *France*, yet it must be acknowledged that such an expence, were it once defrayed, would not only secure the poor and needy from paying exorbitant rates, and

and the rich from the insults of an incensed populace, but preserve both from a publick calamity, which is shocking in its nature, obliges thousands to remove out of the land, and exposes such as stay behind to frequent tumults, and the most malignant distempers.

Prior. The precaution you mention, would not only prevent the evil, but remove the apprehensions of it, which are sometimes as fatal as the misfortune itself. Two or three moons that prove unfavourable to the fruits of the earth, even in a time of plenty, are sufficient of themselves to shut up all the magazines, and introduce a famine. Upon such a publick calamity every one is alarm'd, and all things are in the utmost confusion: The utmost efforts of human wisdom are incapable to appease the clamour; whereas one stock of corn, artfully laid up, and well manag'd, in every province throughout the kingdom, would entirely prevent all such fatal disasters.

Count. Projects of this nature seem plausible enough to us, who are unacquainted with the secrets of state, have been often proposed, indeed, and approved of; but by some accidents always obstructed. We may express our concern for the welfare of our country; but must repose, at last, our trust and confidence in the superior wisdom of the government. Instead of perplexing ourselves with political affairs, let us return to our plants, from which we have made too long a digression.

Countess. As the Chevalier has so short a time to stay with us, I would advise him, during his residence at *Paris*, to make his application to the directors of the royal gardens. When once introduced there, his ears and eyes will be agreeably entertained with real curiosities. Of all the employments of life, none is more simple, natural, and entertaining than the cultivation of plants. For my own part, I confess, 'tis my favourite amusement, and I never pass a day without walking round my garden. In every plot I survey, I meet with something new and very engaging. My mind and my body are at once equally improved. And for the Chevalier's encouragement, I must tell him, the culture of plants is a royal diversion. It has charms for kings and princes, as well as for persons of low degree. And a

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this time the first quality both in *France* and *England* apply themselves as much to the study of gardening as to architecture, or any other useful branch of the mathematics.

Prior. It must be acknowledg'd, that men of fashion, as well as learning, have of late years made the garden not only their amusement, but their real concern. The art of managing the solitary in particular was never carried to so high a pitch of perfection : And there are several now to be seen, where the propriety of the culture strikes the eye as agreeably as the most regular parterre ; and where the discovery of a thousand new secrets for improving the fecundity of plants, and possibly for diversifying the species, must necessarily create more exalted pleasures than those which the most exact forms either of the box or yew-tree could possibly produce in the days of old. This taste reflects an honour on the present age, and demonstrates, that we don't always look down with an eye of contempt on what is solid, but can be rational in our very recreations. I could wish, however, that the art of improving plants, like true piety, was freed from every fantastick scruple, and disengaged from every superstitious practice. People are as much infatuated as ever they were with the influences of the planets over husbandry and gardening. They scrupulously forbear either to plant or sell whilst the moon is in her declension. Profound study has appropriated or set apart particular days for those purposes, and some impertinent gardeners have no other abilities to boast of but their knowledge of these fantastick practices ; notwithstanding at the same time, the falshood of their establish'd rules is daily demonstrated by a thousand experiments, and they themselves can never be so wilfully blind, as not to be conscious of their vanity and insignificance : But when a plant flourishes entirely to their satisfaction, they seem overjoy'd at their having pitch'd on a proper day for the plantation of it ; and the exact age of the moon must be religiously set down in their pocket-books amongst their *Agenda*. And in case the very same plant, either sown or planted by any of their neighbours at a quite different season, proves more forward and promising than their own, they ascribe its

improvement without hesitation to the soil, the air, and the winds. Tho' there, indeed, they shew their judgment, yet still they retain their old idolatrous veneration for the moon.

Count. Now, Doctor, you make some compensation for the distaste you gave me not a minute ago in talking of the moon's having a fatal effect on the fruits of the earth.

Prior. Tho' I talk'd, my Lord, in the common dialect, yet I affix'd to it quite different ideas. As the duration of the winds, which have such a powerful influence not only over the various products of the earth, but our bodies likewise, is measured aptly enough by the continuance of the *phases*, or several aspects of the moon; and as we say one quarter is rainy, and another hot, we are readily inclined to impute that to the moon, which, in fact, proceeds only from the air.

Count. A friend of mine shewed me the very same observation not long ago in a letter publish'd by Monsieur *Normand*, who is the inspector general of his Majesty's olitories, as well as fruit-gardens. According to the best of my remembrance, he expresses himself in one part of it, in the following terms: "From an infinite
" number of experiments, which I have made with the
" utmost accuracy and circumspection, and in different
" years, on all the various operations of gardening, I
" never met with one that countenanced the subjection
" of our predecessors to the different appearances of the
" moon." The authority of so great a man, so nice a judge, and so able and experienced a naturalist, made a stronger impression on me than all the dissertations of a hundred other pretended *Connoisseurs*. It was the opinion likewise of Monsieur *Quintine*, his worthy predecessor, that nothing was more idle and ridiculous than to amuse one's self with the exact observance of the moon's age, when we propos'd either to plant or sell; that, in fact, we ought to do every thing in its proper season, and improve the most favourable opportunity to the best advantage that we can, and then wait with patience for the happy event; not from the particular day in which the operation was perform'd, but from the influence of the sun, and the various dispositions of the air and atmosphere.

Chev.

Chew. Since the operations of the sun and those of the winds are so well known, why should people be so perverse as to ascribe effects to the moon, whose influence never was perceived?

Prior. 'Tis an old prepossession, Sir, and a true reliet of ancient superstition. Those who first regulated the year after the deluge, observed a method which was very commodious, and intelligible to all mankind, in order to settle and adjust the various seasons of the year, and the labours which each of them peculiarly required. They made choice of the several phases or aspects of the moon; and as they constantly had recourse to that planet, to determine the time of their labours, they began, by slow degrees, to fancy that the moon influenced all their operations. And after that, imputing additional powers to her, in proportion as she advanced towards her full, in process of time, they became fully persuaded that what they sow'd either in the moon's encrease, or in her full, was more vigorous and sprightly; and, on the other hand, what they sow'd in her decrease or wane, had a natural correspondence with the moon's imaginary weakness and imperfection. Crabs and lobsters being often found to be very fat and in their prime at the full, gave them, as they thought, a very favourable opportunity of improving their good case and condition at that time into a proverb, or an established maxim, which a thousand experiments since made have proved groundless to no manner of purpose. And since bad winds do frequently blow in the decrease of the moon, the ill effects too consequent thereupon were sufficient to bring that period into disesteem; for which reason it is still look'd upon as pernicious to this very day.

Chew. What think you then of the stars? Why were they imagined to have such influence over us? Nay, why do many people at this very day ascribe to them all that good or evil which accidentally attends them?

Prior. This fantastick notion likewise arises from much the same mistake as the former. The various situations of the sun, who is sometimes placed in one constellation, and sometimes in another, have prevailed on ignorant people to ascribe to those stars themselves, all such excessive heats, rains, or winds as have happen'd

under those various aspects. In process of time they proceeded so far, as to search for the very origin and pre-ordination of every common occurrence, in the various situations of the planets, and the particular aspect of such and such a star, 'Tis this vulgar error, Sir that has swelled the works of the ancients, and especialiy those relating to the improvement of plants, with so many false maxims and groundless observations. The *Georgicks* of *Virgil* himself, tho' the completest piece now extant of pagan antiquity, are disfigured by a hundred trivial remarks on the good or bad qualities of some particular days of the week, or moon, and on the variations of the air, which that poet too rashly imputed sometimes to the aspect of the *Dog-star*, sometimes to the setting of the *Pleiades*, or the rising of *Orion*, or the kids; tho' the reverse as often happened in his time, as it does at present.

Chev. Since we are got amongst the celestial animals, who have been supposed to have such a powerful influence on the plants and animals below, I would fain know why the antients distinguish'd them by the various forms as well as names of living creatures. What is the origin, pray, of the ram, the bull, and all the rest which I have seen delineated on the Zodiack? I have heard their names, and been shew'd their respective situations; but I never knew the reason of these things, which, tho' daily talk'd of, are, in my opinion, somewhat extraordinary.

Prior. 'Tis no easy matter, Sir, to give you perfect satisfaction in regard to this whimsical language, which seems to be introduc'd amongst mankind soon after the flood. However, there ought to be some distinction made, and we should not form the same judgment of the names of the twelve signs of the Zodiack, as we do of the other constellations of the sphere. The learned are of opinion, that the *Egyptians* gave to the twelve signs, the several names ascrib'd to them: It being a custom amongst them, to disguise things worthy of their observation, under the form or symbol of a known object, that bore some resemblance to that which was conceal'd. For instance, I am very much tempted to believe, that they represented the Supreme Being, and his Divine At-tributes,

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tributes, such as his immensity and omnipotence, his fecundity and infinite perfection, under the symbol of the sun; that they represented nature or matter, which is altogether dependant on that Supreme Being, and diversified every moment, under the image of the moon, who borrows her light from the sun, and is perpetually changing her appearance: And this, in all probability, was the foundation, or one of the principal causes of idolatry and superstition; men growing forgetful by degrees of the Supreme Being, and confining their attention to that glorious luminary the sun, or considering it, at least, as the representative of the Deity. But be that as it will, the *Egyptians* were extremely fond of hieroglyphicks, and the twelve signs of the Zodiack were always called by the several names assigned to them, in conformity to their own method, and peculiar taste. They are capable, likewise of some reasonable explications. But as to the greater part of the other stars of the sphere, the names by which they are distinguished were given to them by the *Grecians*, through mere caprice, without any grounds or reason, at least as far as we can discover. They imitated, indeed, the *Egyptians*, in assigning to the stars the names of men or animals, with this difference; that the old *Egyptians* gave symbolical names to some particular stars, on account of the conformity which there appeared between the symbol and the constellation; whereas the *Grecians*, who were perfect strangers to any such affinity or relation, and testified a profound veneration for the wisdom of the eastern nations, notwithstanding their taste for fable was most wretchedly depraved and invented a hundred poor conceits, with respect to the origin of the animals in the Zodiack, and applied to the other stars, the names of such heroes and animals as were most known in their wretched metamorphoses.

Chev. Let us have no more then to do with either the *Greeks* or their fables: But I should be glad to hear what reasons the *Egyptians* could have for calling one set of stars *Cancer*, another *Leo*, *Virgo*, or *Pisces*.

Prior. As I think all of them will bear a reasonable explication, I'll endeavour to gratify your curiosity, and freely offer you my conjectures.

under those various aspects. In process of time they proceeded so far, as to search for the very origin and pre-ordination of every common occurrence, in the various situations of the planets, and the particular aspect of such and such a star, 'Tis this vulgar error, Sir that has swelled the works of the ancients, and especialiy those relating to the improvement of plants, with so many false maxims and groundless observations. The *Georgicks* of *Virgil* himself, tho' the completest piece now extant of pagan antiquity, are disfigured by a hundred trivial remarks on the good or bad qualities of some particular days of the week, or moon, and on the variations of the air, which that poet too rashly imputed sometimes to the aspect of the *Dog-star*, sometimes to the setting of the *Pleiades*, or the rising of *Orion*, or the kids; tho' the reverse as often happened in his time, as it does at present.

Chew. Since we are got amongst the celestial animals, who have been supposed to have such a powerful influence on the plants and animals below, I would fain know why the antients distinguish'd them by the various forms as well as names of living creatures. What is the origin, pray, of the ram, the bull, and all the rest which I have seen delineated on the Zodiack? I have heard their names, and been shew'd their respective situations; but I never knew the reason of these things, which, tho' daily talk'd of, are, in my opinion, somewhat extraordinary.

Prier. 'Tis no easy matter, Sir, to give you perfect satisfaction in regard to this whimsical language, which seems to be introduc'd amongst mankind soon after the flood. However, there ought to be some distinction made, and we should not form the same judgment of the names of the twelve signs of the Zodiack, as we do of the other constellations of the sphere. The learned are of opinion, that the *Egyptians* gave to the twelve signs, the several names ascrib'd to them: It being a custom amongst them, to disguise things worthy of their observation, under the form or symbol of a known object, that bore some resemblance to that which was conceal'd. For instance, I am very much tempted to believe, that they represented the Supreme Being, and his Divine Attributes,

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Chew. Let us have no more then to do with either the *Greeks* or their fables: But I should be glad to hear what reasons the *Egyptians* could have for calling one set of stars *Cancer*, another *Leo*, *Virgo*, or *Pisces*.

Prior. As I think all of them will bear a reasonable explication, I'll endeavour to gratify your curiosity, and freely offer you my conjectures.

The old *Egyptians*, having first observ'd the four natural divisions of the year, perceiv'd that the sun, in each of those seasons, was placed successively under distinct stars. In order therefore, to be as exact as possibly they could, and to parcel out the year in such a manner, as should be most commodious and unalterable, they divided each of the four seasons by three cantons of different stars, and the whole year into twelve houses, or stations of the sun, to which they gave the name of twelve different animals, that had relation to what was transacted upon earth, in each of those divisions of the year.

The sun, in spring, covers the earth with a vast variety of inestimable blessings. Those which the antients were peculiarly fond of, and valued most, were sheep, kine, and goats. In order to adumbrate, therefore, these numberless benefits, and that fecundity which was restored to them by the spring, they gave to the three constellations, through which the sun passes in the spring the names of those three different creatures. The first constellation under which the sun is found, when the winter is withdrawn, and the days and nights are equal, was distinguished by the name of the first animal that is usually brought forth at that particular period; that is to say, the lamb, or its parent the ram. The second bore the title of the bull: And as the goats who are hot * in *November*, and pregnant for five months, bring forth two young ones oftener than one, at the expiration of that term, the third constellation of the spring bore the denomination of the twins, or kids †.

When the sun is arrived at the summer solstice, he advances no farther towards the pole, but returns with abundance of gravity and precaution, as it were, to the equator; for which reason the *Egyptians* thought proper to assign the name of the crab to those stars, under which he then appears. The manner in which this animal marches is well known, and nothing could more aptly adumbrate the retrogradation of the sun. The excessive heats which next come on, and the full lustre in which

* Vide Hyde's Relig. Persar.

† The Greeks have substituted in their room, tho' without any foundation, the two brothers Castor and Pollux.

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that glorious luminary then appears, induced them to give the constellation, under which he then moves, the name of the lion, the king, and terror of all terrestrial animals. The harvest which immediately succeeds, inclin'd them to delineate the sixth constellation by the figure of a young female reaper, bearing an ear of corn. The emblem or allusion is taken from those young virgins who gained their livelihood by gleaning after the reapers; and nothing could be a more lively representation of that season of the year, when Providence is lavish, as it were, of her favours, and supplies both rich and poor with plenty of provisions. The Chevalier is desir'd to observe, that the ear of corn which she holds in her hand, in the *Hebrew* language is called *Shibboleth*, and in *Arabia*, *Sibbul*, or *Sibbula*.—*Hebrew* and *Arabic*. This is strange conversation, indeed. Let us reserve it for another year.

Countess. I must beg the favour of you, Doctor, to proceed. You were going, I presume, to acquaint us with the origin of the *Sibyls*. I am as curious, Sir, as some others may be.

Prior. The name then of the ear of corn, or *Sibyl*, was given to the virgin herself who carried it. Nothing can possibly be more simple than this name in its original. Fiction, however, in process of time grew fashionable; and what was only a symbol at first, was converted into a history. It was suggested, that this *Sibyl* had been transported from the earth into heaven; and in order to qualify her for the journey, they supplied her, in the figures by which they represented her, with a pair of spacious wings, and zealously asserted, that the Spirit of God was infused into her, and that she foretold years of barrenness and plenty. From hence arose the *Erythraean Sibyl*. The history likewise of the *Persian* and *Cumæan Sibyl* was cast in the same mould. In short, all such women or priestesses, who undertook to divine themselves, or collect the prophecies of others, whether antient or true, or modern and false, were look'd upon as so many *Sibyls*. But we have been too tedious on this topick, let us resume our discourse concerning our constellations.

'Twould be impossible to express that which the equinox falls under, and equals day and night, by any better symbol than that of a ballance in equilibrio. The va-

rious distempers occasioned by the sun in his retreat, or which break out in the middle of autumn, made them give the next set of stars the title of the *Scorpion*, because that animal carries not only a sting, but a bag of poison in his tail, and makes use of both as he finds occasion. The *Sagittary*, * or archer, who follows that destructive animal, has a visible relation to the chase, or the diversion of hunting, which is principally follow'd after the fall of the leaf. As the crab, that crawls with a retrograde motion, was made the symbol of the summer solstice, after which the sun always returns to the equator; so on the other hand, in order to delineate the winter solstice, after which the sun rises, and continues his progressive motion to the other tropick, the name of *Copricorn*, or the goat, was chosen; because these animals most commonly climb as they browse, and continue ascending and feeding, 'till they have reached the summit of the rocks and mountains. The water-pot is a lively image of the hail, rain, and snow, that fall in the dark winter-season. And lastly, the two fish, which are link'd together by a fillet or bandage, seem to have reference to the generation of those animals, who make their appearance about the close of winter, at which period, angling begins to come in season. I hope you'll excuse the freedom with which I have offer'd my conjectures. I am conscious to myself, they are not all satisfactory alike.

Count. Your explications, Doctor, carry along with them an air of probability; and though all of them may not possibly please alike, yet they are sufficient to make us comprehend, that some such conformities as these gave the antients an opportunity of delineating the signs of the Zodiack under the names and figures above-mention'd; which, at one blow, saps the very foundation of judicial astrology, and the superstitious practices of some gardeners, in the cultivation of their plants.

Cher. Gentlemen, I return you many thanks for all your favours. I am now going to my closet, in order to add these minutes to those I have already taken of our past conversations; and when I have done, shall beg the
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* The Greeks instead of a hunter, have substituted the fabulous idea of a centaur,

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favour of the Prior to revise and correct the whole before my departure. For I propose to let all my friends see what a proficiency I have made in my studies, through your instruction and indulgence.

Countess. Chevalier, if you'll oblige us with your good company the next long vacation, I'll promise you a second volume, provided the Prior and his Lordship will be my spectators.





A
L E T T E R
FROM THE
Chevalier to the Prior.

Reverend Sir,



Aving just dispatch'd a short address to the Count and his good Lady, to testify the gratitude I owe them, not only for the courteous reception which they gave me, but the more valuable pleasure of their charming conversation; I think myself equally obliged to express a thousand acknowledgments to yourself, for the repeated instances of your indulgence towards me. Without a compliment, Sir, I shall always look upon that time which I lately spent in your company, as the most instructive and entertaining part of my life. You have conducted me, as it were, into another world, and open'd to my view a new scene of ravishing delights. Till that time, I beheld all objects like an infant; but through your friendly instructions, I am now enabled to make a right use of my eyes, to know the things which were made for my service, and to enjoy them without reserve, as my indisputable right. I have acquainted my brother and his young bride with the agreeable manner in which I spent my last vacation. Our whole family, Sir, are at present philosophically inclined.

inclined. Every object engages our attention, and is subject-matter for discourse. We have a thousand things to say upon whatever we meet with accidentally in our walks, and upon each dish, how inconsiderable soever it be, that is brought to table. An oyster-shell, or the husk of a filberd, is employment sufficient for several hours. We are very strict in our enquiries into the origin, formation, and use of every object that presents itself to our view. We had a warm debate yesterday with our neighbour the captain, upon this head. As you know the gentleman, I cannot forbear giving you a particular detail of what passed between us. He insisted, that we lost all our time in applying our minds to the study of nature; that all our knowledge was imperfect, nothing but mere conjecture, and liable to a thousand misconstructions. He allowed, indeed, that we might form some tolerable judgment of part of those larger vessels which contribute towards the support of an animal's body; but that we could never be able to distinguish aright the more minute vessels which were requisite for the nutriment of the former; and much less, to entertain any adequate idea of the texture of the smallest. As, therefore, said he, the knowledge of the one, is of no real service without an acquaintance with the other, it was labour in vain for us to enter upon a work, and to be curious in our inquiries into the nature of it, when we are conscious before-hand that all our endeavours will prove unsuccessful. Tho' this way of reasoning carried but little weight or authority with either of us, yet I was very desirous, I confess, that my brother should enter into the debate, and undertake to refute such a train of false positions. Whereupon I ask'd him, whether what had been advanced had made any impression upon him, and whether he thought an object was actually lost, when the sight of it was intercepted by any casual mist. To this I added with a smile, that when I first lodg'd at *Paris*, I had a full prospect from my window, of the *dome* of the *Invalids*; and that whenever the air was in the least foggy, I could not conceive what was become of it; and because I could discern no part of it, I imagin'd that there was in reality no such thing, and that 'twas only an illusion. My brother piqu'd at my

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comparison, resumed the discourse with some warmth, and insisted, that such difficulties neither destroyed the certainty of those things which we already knew, nor discouraged us in the least from making new discoveries; that tho' some points were very abstruse and mysterious, yet there were others no less easy and obvious; and that we ought not to embarrass ourselves, and employ our whole thoughts in such enquiries as are above our reach, but in those only which are best proportioned to our capacities. This reply of his, which was looked upon as very judicious and *a-propos*, is the same, in effect, which I once heard, Sir, from your self, when engaged in a conference, wherein you made an exact estimate of the power and sufficiency of reason. Without flattery, Sir, I was then charmed with your discourse, and I should think myself infinitely oblig'd to you, if you would reduce those particulars into writing, and send me a transcript of them as soon as will suit with your convenience. As you have taught me some time since the *art of thinking*, you must now proceed, and direct me how to *think aright*. My brother, who has perused my letter, and made such additions to it, in regard to himself, as he thought proper, desires his sincere respects may be accepted, and joins his humble request with mine, that you would indulge us with an illustration of that important subject.

Tho' we entertain no thoughts of making a proselyte of the captain, since the attempt, we are sensible, would be altogether vain and fruitless; yet we would not willingly be bewildered, or deviate, as he does, from the knowledge of the truth. I am, with the utmost gratitude, submission, and esteem,

Reverend SIR, &c.

A LET



LETTER

FROM THE

Prior to the Chevalier,

On the Power and Insufficiency of *Reason*.

AS you are no stranger, I am sensible, to the many very valuable advantages that result from the arts and sciences, it would be needless for me to expatiate on that head ; and as a thirst after knowledge is at present your darling passion, it would be equally unnecessary to press you to be curious. However, that passion, tho' never so laudable in itself, and productive of the most happy effects, when under due restriction, may, like some other affections of the mind, prove very pernicious, if indulg'd to excess. Knowledge, instead of contributing towards some people's improvement, only elates their hearts, and puffs them up with pride. There are men of learning in the world, of whom it may justly be said, that it had been much happier for themselves as well as others, if they had remained for ever ignorant and incurious ; since they abuse their attainments in the most shameful manner, by perverting the true use of those rational faculties, with which they are endowed.

Tho' curiosity is, doubtless, a very commendable qualification, yet we ought not to indulge it beyond measure ; and in order to keep it within its due compass,

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we ought to be well acquainted with its proper extent. And this is the subject which I propose to enlarge upon at present, in compliance with your request. Tho' this short essay, my dear Chevalier, may probably seem more abstruse, and less intelligible than some of our late conversations; yet let me advise you, upon your first perusal, to look upon it as a history only; and if you should meet with any particular passage which you cannot rightly comprehend, never perplex yourself about it, but proceed without the least concern or hesitation; since it will, doubtless, grow more familiar to you upon a second revial. If, however, you should even then remain in the least uncertainty about it, you can but place it at worst at the end of your diary, when you have communicated the contents of it to your brother, and lay it aside till you have made some farther progress in your studies.

The limits of curiosity are, without dispute, the very same with those which are prescribed to the reason of all mankind, and to the state and condition of each individual: By our not knowing the exact measure and true intention of our reason, we too often, indeed, deceive ourselves, not only in the choice of such things as we are desirous of knowing, but in that degree of light to which we would, if possible, extend our knowledge.

'Tis a concern, however, of the last importance to us, to form a right judgment in this particular, and to make an exact estimate of what our rational faculties can accomplish, and what they are incapable of performing. The knowledge of the former may encourage us in our researches; and our consciousness of the latter may prevent us from making too many vain and fruitless attempts: But 'tis no small misfortune, that our young gentlemen are extremely apt to be either insensible of the real value and privileges of their reason, or else to entertain a too exalted opinion of its power; from whence it follows, that they either abandon it altogether, or fondly aim at extending it beyond its proper bounds.

In this present age we are encompassed with a multitude of dangers. The variableness of constitution, the constraint of application, the charms of pleasure, the force of example, a thousand causes, in short, render
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reason despicable in our eyes, and that prerogative, which is man's chief glory and happiness, perfectly useless. The desire, on the other hand, of informing our judgments, the glorious success of some learned gentlemen, the honours and advantages that result from the sciences, the pleasures that attend a studious life, our peculiar talents, and our partial indulgence to ourselves, when we are strangers to the just limits of those faculties with which we are endowed, may prompt us to such presumptuous researches, as either lead us into a labyrinth, or, by their proving fruitless and unsuccessful, make us peevish and fly out into unjustifiable murmurs and invectives against the frailties of our nature.

Those *very literati*, to whom we with confidence apply, as our surest guides, in a path which they ought to be much better acquainted with than ourselves, may possibly be the first that shall lead us astray, and promote our delusion. Some of them, who abound more with cavils, than sound principles, are for ever in a state of hesitation, and discourage us in our pursuits after truth. We are surprised that such ingenious men should be so unsettled in their principles. Their example misleads others, who upon a too firm persuasion that they shall never acquire any satisfactory knowledge, in consequence of their despair, devote themselves entirely to their pleasures, and to an uncertainty of mind, which too often proves more incurable than immorality itself. On the contrary, there are others who flatter us with too fair promises. These would persuade us, if possible, to entertain a more exalted opinion of our reason than we ought. They subject every thing to their examination. They meet with no difficulties but what they can easily get over, and were you to converse with them, you would think they were intimately acquainted with all the *arcana* of nature. In the twinkling of an eye, they unhinge the whole material frame, and range it again in such order, as they judge most convenient. They are the partizans, or abettors of an imaginary system, that takes in the whole universe. They are neither strangers to the play of those powerful springs that move the earth, nor to the structure of the most minute particles whereof it is composed. They talk of
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every individual thing, and give their ready solution with the utmost confidence on the whole.

How often are we forced, however, to set bounds to these extravagant pretensions! When we are disposed to be free and ingenuous, we must confess, that tho' nature is so far exposed to our view, as to present us with a glorious prospect; yet all the internal parts of it are entirely concealed from our eyes: The play of the several machines, the particular structure of the various parts, and the composition of the whole, are all secrets, of which we can form no adequate idea. Tho' we survey the external surface, and reap the benefit of it; yet the perfect and distinct knowledge of the depths and mechanism of nature, seems an indulgence not to be granted us in our present state.

We resemble, in a great measure, those travellers, who set out at the break of a summer's day. A glimmering, tho' an agreeable light, begins to colour the objects that present themselves to our view. We distinguish, at least, those which lie nearest to us, and never confound the river with the banks, or the shore that confines it. This answers our purpose, and we are thereby enabled to pursue our journey. The day notwithstanding, does not break out as yet in its full beauty and lustre.

Would we enquire with modesty into the true reasons why our faculties have been contracted within so narrow a compass, we should find, that the measure of them is duly proportioned to our wants; that our illuminations are well adapted to our present state and condition; and that we had been less qualified to answer the wise ends of our creation, had they proved more extensive. We are planted here, in order to lead a virtuous life. Our reason is subservient to our senses, by the aid and assistance whereof it is informed of every thing that relates to the life it presides over and protects. This reason is dependent on a body, and accompanied with a variety of subordinate members, which were bestowed upon it, not for reflection, but the regular performance of an infinite number of good works. These were the wise purposes for which it was given us, and had our faculties
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Tho' a traveller, in order to pursue his journey in a right manner, should be able, 'tis true, to distinguish the various objects that surround him; since otherwise he could make no use of one, nor be on his guard against another; yet there is no necessity for his being intimately acquainted with the nature of each tract of land he travels over, or of the river that rolls gently by his side. 'Tis sufficient for him, that he follows the high road he is in, and runs into no unnecessary danger. Were he more curious and inquisitive, he would stop too long by the way, to reflect on the particular qualities of the adjacent stream: He would endeavour to search out the source, the origin, and first cause of it. He would discover, if possible, what little rivulets there were that ran into it, and swelled its waters; his curiosity would lead him to know what quantity, and what species of fish were contained in it, and the nature of the various plants that embellished the margins of it; his eyes would be forever roving from one object to another, and his journey, in short, would never be accomplished. This is a lively image of our state and condition in this life.

It must be allowed, indeed, that the contemplation of truth is highly requisite, whilst we are here on earth; and 'tis equally necessary, that some discerning travellers should go before us, to survey the roads, and set up proper boundaries and land-marks, in such places as are least frequented; and that their discoveries should be directions to those who follow them. This is the peculiar province of such as are men of the brightest parts; who are appointed by Providence for the guidance and instruction of their fellow-creatures. Those studies, however, which are productive of no good effect, those speculations, which are altogether barren, and neither contribute towards the improvement of our hearts, the regulation of our conduct, or the benefit and advantage of society in general, are mere deviations; amusements, which are unworthy of our regard, and supply the place of proper employments. The good Providence of God, by the contraction of our rational faculties, has been indulgent to us, and prevented our falling into these
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manifest inconveniencies. Were the eyes of our understandings more illuminated, we should be more solicitous about what we saw, than what we did : We should scorn to grovel as we do upon the earth, could we but behold the stars, or form any idea of what is transacting in those upper regions.

A few particulars will demonstrate this truth beyond all contradiction. Let us suppose some laborious husbandman now standing before us. Such a man, if-viewed in a disadvantageous light, and in comparison with some others of his fellow-creatures, would appear to us a just object of our commiseration. He is rough and unpolish'd ; toils all the day long ; is a perfect stranger to all elegant amusements ; and knows nothing of the bewitching charms of riches or honours. Shall we conclude then, that the Almighty had neglected this poor man, in order to bestow his favours on others with a more lavish hand ? By no means : This would be setting him in the worst and most delusive point of sight. What place then does he possess in the order of Providence ? He is appointed for the culture of the earth, which of all employments is the most necessary and important. As therefore he is sufficiently qualified for his station, he is provided with all the talents that are needful for him. Was his penetration stronger, he would not answer the wise purposes for which he was appointed. Had he the least notion of pleasure or ambition, he would think himself very unhappy, by living in a state of obscurity and fatigue ; and 'tis not only a great advantage to himself, but a much greater to society, that his understanding is so weak, and contracted with such narrow limits. Was the shepherd a man of discernment, delicacy, or taste, would he ever be prevailed upon to tend his flock all night as well as day ? Would not he think it a deplorable mortification, to be oblig'd to pass his whole time in so servile an office ? And yet, were the earth and cattle alike to be neglected, discord and confusion would instantly ensue, and we should soon be divested of all the conveniencies of life. As therefore the peasant's want of politeness is our happiness, it would be an act of the highest ingratitude as well as injustice in us, should we make his want of knowledge the object of

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our contempt or derision. Our idea, however, of this man, may be applied to a thousand others. This rough-hewn countryman is the whole species in one, is the representative of us all. We were all planted by our Maker here upon earth, for its cultivation and improvement, and by our labour to render ourselves useful in our generation. It must be confessed, 'tis true, that a variety of employments requires some difference between the talents and faculties of one man and another; but then those talents and those faculties have their respective bounds, beyond which we can never pass; and should we once rashly attempt to make any farther advancements, we should plainly discover an unwarrantable inclination to move out of our sphere. Of what advantage would it be to us, could we penetrate to the very bottom of beings; could we unravel the most curious texture of the organs of a body; could we discover how those invisible vessels which nourish it can subsist of themselves; could we form a judgment of what the elements of those vessels are, and even the first principles of those elements; could we pry, in short, into infinity itself? These were never the wise purposes for which we were created. To abandon therefore those truths which are obvious to our view, in order to rove about in search after such points of knowledge as are too intricate and abstruse for us; to affect a superior degree of wisdom, and decline industry and action, is to deviate from the path of virtue, which is plain and open, and to find out new tracks for ourselves, where we are obstructed every step we take, and meet with such difficulties as we can never conquer. 'Tis to resist, in short, the order established by the Almighty himself, who, tho' he has given us light sufficient to direct us to our welfare, has not dispersed all mists from our eyes; and when he vouchsafed to add revelation to reason, his design in that act of indulgence was not to remove the veil, that conceals the true knowledge of things from us, (for the time is not yet come) but only to clear up those scruples, which might possibly embarrass us, with regard to the way in which we should walk.

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If, however, it be meet and requisite, that we should be fully convinced of the weakness of human reason, in some certain points, and should acquiesce without reluctance in the appointment of Him, who orders and disposes of all things according to his own good-will and pleasure; yet it is equally just and necessary, that we should know the real value of that reason, and exercise it according to its ability and extent. Next to faith, which alone informs us of whatever we are to believe, practise, and hope for, there is no blessing in this life so precious and invaluable as reason; for tho' it does not, indeed, penetrate to the very bottom and nature of objects; yet it is conscious of the excellency of them, and helps us not to confound them.

It clearly discerns their external parts, and is sensible of their operations and effects. It beholds their relations, number, agreements, properties, and use. Tho' it be not furnished with such ideas as are perfectly clear, yet it improves those informations it has to the best advantage. It enjoys its rights and privileges, and is as cautious, as the traveller who observes the various commodities peculiar to each country through which he passes, knows all the roads, their conveniencies and inconveniencies, and, without stopping any considerable time at any one place, not only takes notice of what he sees, but makes use of the whole.

In order to be more fully convinced of the excellency of our reason, and the indispensable obligations we lie under to improve it to the utmost of our power, we need do no more than compare it with what we have most active and perfect here upon earth, and reflect a little what station it possesses there, and what operation it performs.

When we enquire into the various animals, with which all nature abounds, we may perceive in every one of them a particular industry, and a prudent forecast in measures which they all take to support and maintain their young. They have an imitation, 'tis true, of reason; because all their actions tend to some end: And tho' the operation of the Divine Power and Wisdom is too visible in them to be mistaken, which has varied their way of life, and imprinted on each species a rule of action, from which they never swerve; yet we must

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not imagine that they are endowed with any understanding, since they have no degree of reason. That wisdom, by which all their motions are directed, resides in some other place; for if they had it within themselves, and could think and reason, we should not find them so much confused, or so dull and untractable, as they are, when once taken from the way of life peculiar to them. Had a spider all the art and contrivance of a weaver, she would not employ all her time in spinning of her web. If the swallow had the skill of a mason, her nest would be composed of other materials than mortar. Were animals capable of reflection, they would never be confined to one unalterable track. They would be daily entertaining new ideas. The principle of reason would then be fruitful in them. It would display itself by some air of curiosity, some new schemes, and new operations. The variety of their thoughts would, doubtless, have a different influence and effect upon their labours. As to the industry of man, it is quite another thing. 'Tis not in him as in other animals, an impression of dexterity and address, of activity and vigour, for the production of one determinate and uniform operation, by proportionable organs. Man's reason is an active fertile principle, that knows, and would be incessantly augmenting its informations; that deliberates, wills, and chuses without restraint; that operates, and, if I may be allowed the expression, is forever creating of one new work or another. By this noble faculty, man is enabled to imitate the fabrick of the world in a globe, which exhibits, in the exactest manner that can be, all its springs and revolutions. It bestows upon him likewise, something still more glorious and more beneficial. He becomes so well acquainted (by means thereof) with the beauty of order, as to make it the object of his admiration, to have a taste for it, and to practise it in all his undertakings. He can imitate the Deity himself; and 'tis his reason that renders him the image of his Maker upon earth.

This faculty makes him not only acquainted with the external part of each object that is presented to his view, its excellence and beauty, but gives him the actual enjoyment of it. 'Tis this reason, that constitutes him the sole lord and master of the whole universe; that puts him

him into the full possession of his empire, and gives him an absolute power and dominion over all his subjects.

It must be confessed, indeed, that man is not endow'd with the activity of some birds, who in an instant, as it were, transport themselves from one place to another by the aid and assistance of their wings; and that he has not the vivacity and vigour of such animals, as are armed with strong horns, griping claws, and devouring teeth. He is not arrayed, 'tis true, like them, by the indulgent hand of nature. He comes into the world perfectly naked; and has no plumage, fur, or scales, to secure him from the injuries of the weather. Is it compatible with the dignity of the sole monarch of the earth to make his first appearance in such a helpless state and condition? Since he is endow'd with reason, he is rich in himself, and plentifully provided with all the accommodations that he stands in need of. By this faculty he is taught, that whatever the creatures round about him enjoy, it is all devoted to his service; that in effect they are his slaves; and that their lives and actions are wholly at his disposal. If he be fond of game, for the entertainment of himself or his friends, his dog, or his falcon, animals that are habituated to the sport, is immediately dispatch'd, and he is soon accommodated, without the least inconvenience or fatigue to himself, with the provisions he desires. If in one season, he chuses to appear in a quite different dress from that which he puts on in another, the sheep resign their fleece to him without the least reluctance, and the silk-worms spin for him a lighter and more sumptuous vestment. The creatures are his daily maintenance and support, as well as his guards both by day and night; they fight for him, cultivate his grounds, and carry his burdens, tho' never so cumbrous, wherever he pleases.

This superior faculty of his not only makes the creatures, but even things inanimate obedient to his will. His reason makes the stateliest oaks descend from the mountains, and obliges the most massive stones to start from their subterraneous caverns, to furnish him with commodious habitation. Was he inclined to remove from one climate to another, to traverse the ocean, and

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visit the most distant countries ; was he disposed to export some commodities thither, with which he is over stock'd ; and import such others from thence in their stead, which he stands more in need of, and will prove more to his advantage, he makes the very winds and waters contribute to his service : By his rational faculties, not only the elements, but all manner of metals are made subservient to his wants ; and every object, in short, that surrounds him, is subject to his directions.

As diminutive a creature as he is, his reason confers on him a power, which is only circumscribed by that earth which he inhabits. He brings, if I may be indulg'd the expression, the two extremities of the globe together, and settles a correspondence between them, without stirring from his closet.

His thoughts are painted, as it were, in his letters, which, without the least inconvenience to himself, are convey'd from one nation to another, and give intimation of his will to his agents, who are two or three thousand leagues distant from him. He keeps up an intercourse with all the world, and after his decease, is capable of entertaining the latest posterity. Reason is not to be traced through all her wonders. She improves and embellishes all states and conditions whatsoever : And her influence is no less to be admired in the dexterity and address of an artizan, where she appears a fund of beauty and convenience, than in the conversation and compositions of the learned, where she proves an inexhaustible source of instruction and relief, of consolation and delight.

Reason joins, even to such beautiful productions and valuable advantages, some other privileges, which still aggrandize and ennoble her the more. She is the center of God's works, the chief end for which they were created, and she it is that constitutes their order and beauty. Were we but for a moment to take reason from the world, and suppose that there was no such created being as man, there would be no harmony in the works of Nature, and all things would be in the utmost disorder and confusion. The sun communicates his light to the earth, but then she is blind, and incapable of receiving any benefit from his lustre. By the genial heat of that resplendent

dent luminary, the rains and dews, indeed, make the seeds shoot up their verdant heads, and cover the fields with a variety of corn and fruits: But then these treasures are produced in vain; since there is no proper person either to gather, or consume them. The earth, 'tis true, affords nutriment to the animals, but then those animals, for want of a proper master to exercise those good qualities with which they are endow'd, and, if I may be allow'd the expression, to concenter their services, are altogether useless. Tho' the horse and the ox are duly qualified, in regard to their strength, to drag after them, or carry on their backs the most cumbrous loads; tho' their feet are sufficiently fortified with impenetrable horn, and by that means, they are enabled to travel through the most rugged roads; yet they stood in need of no such vigour and strength of body, no such armed hoofs to render them capable of trampling down the grass, where they seek their pasture. The sheep are incommoded with the weight and impurity of their own fleeces, and the cows and goats with their extended udders. Inconvenience at least, if not downright contradiction, is conspicuous through the whole. Tho' the earth incloses in her bowels such massive stones as are proper for building, and metals for the making of all kinds of vessels; yet she has no guest to entertain, no artist to make use of those materials to advantage. Tho' her surface is a spacious garden, yet there is no one to view it. Tho' all nature, indeed, is a most delightful prospect, yet no one enjoys it. Let man be restored, and reason resume her former station, intelligence, relations, and unity will in an instant reign throughout the whole; and those very things which did not seem created for the service of man, but in a more peculiar manner for animals or plants, will, notwithstanding, have some visible relation to him, by the benefits and advantages which he receives both from the one and the other. The gnat deposits her eggs in the water, and from them a species of insects are produced that live some considerable time in that station, before they have vigour enough to stretch the wing, and mount in the regions of the air. These vermin are the principal support both of water-fowl and fish. And since all these are created for the use of man, it is doubtless,

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doubtless, for his interest and advantage, that those insects should exist. He approaches all other beings in the same manner. His presence is the band which knits the various parts together, and constitutes the whole. In a word, he is the soul that informs them.

To conclude, reason not only makes man the center of the creatures that are round about him, but she constitutes him likewise their priest, and the interpreter of their most grateful acknowledgments. 'Tis by his mouth that they pay their tribute of praise and thanksgiving to that all-wise Being who created them for his own glory. The diamond is not conscious of its own worth, neither is it acquainted with him who bestow'd upon it such a radiant lustre. The brutal part of the creation know nothing of him, by whom they are so commodiously array'd, and so plentifully supported and sustained. The sun himself knows nothing of his Maker. 'Tis Reason only that can discover the Supreme Being: And since she is planted between the All-wise Creator and the creatures void of understanding, she is highly sensible, that in her use of them, her tribute of gratitude, love and adoration to so liberal and indulgent a benefactor, is a duty highly incumbent on her. All nature would be speechless, if she was absent. Every part of it, however, through her mediation, proclaims the glory of him to whom they owe their existence, and all the good qualities of which they are possessed. She alone is conscious that his eyes are upon her; she alone is sensible of the favours received at his hands; and she enjoys the inexpressible happiness of being qualified to adore the Divine Majesty for whatever is in, or round about her. Where reason is, there should religion be also; and man lies under an indispensable obligation to be active in his devotions, in proportion to that degree of reason with which he is endow'd: 'Tis evident, that he is careless and remiss in his duty, according as his reason is sunk and depraved; and this misfortune constantly attends him, whenever he perversely aims at such attainments as are above his reach, or is inattentive to those things which were design'd by Providence for his practice and improvement.

Thus have I given you, my dear Chevalier, a transient view of the benefits and privileges of reason. And they are indisputably so very great, that man, instead of having any just grounds for complaint, ought to stand astonish'd at the infinite variety of discoveries and productions that are within his power. And the more conscious he is of the dignity and excellence of his reason, the more sensible will he be of the necessity there is for his cultivation and improvement of it. The main point, however, wherein such improvement consists, is to be continually exercising ourselves in the contemplation of such objects as are not only proportion'd to our capacities, but have some tendency to make us better and more happy. Let us consider how we ought to demean ourselves on a thousand occasions, by that behaviour which is absolutely necessary in one single instance. Nothing is more beautiful than the light; nothing more worthy of our regard and attention than that glorious orb to which nature is indebted for all her charms. Let us acquaint ourselves, then, at least with one part of what may be known of it, especially that which may be known to advantage. But to render this point still more obvious and easy, we shall illustrate it by a very familiar instance.

I find myself in a stage-coach, with two philosophers, one on each side of me, whose opinions are almost diametrically opposite. I'll suppose that we enter'd upon our journey at midnight, and that all the hours before break of day were attended either with fatigue, or more agreeably spent in sleep. At last, the sun begins to rise, and all the company are perfectly awake. Some few cursory reflections on the great benefits and advantages arising from light and colours occasion a warm debate between my two fellow-travellers, and their discourse turns wholly upon the nature of light. One of them boldly undertakes, not only to explain what light is, but the particular ideas likewise which we entertain of it. The other as presumptuously asserts, that both are unintelligible; and closes with this remark, that tho' man, in his utmost extent, is but six foot high, and two in circumference, yet he vainly imagines he can form an adequate idea of nine feet, a hundred feet; of the extent of a plain;

plain; nay, of the exact distance between the spot where he stands, and the stars in the firmament. From hence, he observes, that since 'tis absurd to maintain that he can have in himself any actual idea or measure of such objects as are of a much larger extent than himself, it must undeniably follow, that 'tis impossible for us to see, and that there is in effect no such thing as vision; that all things are absurd and uncertain, and that it was much to be question'd whether he made one of the company in the coach or not. I listen, we'll suppose, with attention to them both. As soon as the debate draws towards a conclusion, and the warmth of the contending parties begins to abate, they make their appeal to me, and beg that I would determine the controversy. Gentlemen, says I, I'll give you, if you please, my sentiments very freely in the case before us, without the least partiality or reserve. You began your discourse with expatiating on the inestimable benefits, and the various uses of light and colours: Tho' the point in debate is very plain, and the solution of it very easy and obvious, yet each of you deviate from your subject, to wander into a labyrinth, and start such difficulties as are quite foreign to the affair in hand. You, Sir, to whom no point whatever seems intricate or perplex'd, too rashly pretend to explain, not only what light is, but the ideas likewise which we entertain of it. You, Sir, on the other hand, accusom'd to a perpetual hesitation, are not fully persuaded that you see the sun. One of you is ambitious of knowing what is forbidden, and above the reach of our capacities; and the other is too scrupulous, would be ignorant even of those objects that lie before us. Let us rather aim, Gentlemen, at the knowledge and improvement of such things as are within our power, than vainly search after those which are too mysterious and abstruse, or suffer what we are in the possession of to continue altogether useless. Tell me ingenuously, Gentlemen, what thoughts would you entertain of two young artizans, who being apprentices, we'll suppose, to a watch-maker, and having received a sufficient quantity of proper materials and tools from their master to make some curious wheel, should, instead of obeying his orders, waste their whole time in an idle

debate about the nature of the metal with which they had been intrusted?

The watch-maker might very justly reprimand them, in terms to this, or the like effect. Ye idle, trifling blockheads! I did not give you my materials to make your impertinent remarks upon, but to prepare them for my use. 'Tis no concern of yours to enquire what the metal is, or the qualities of it, whether proper or improper, for the intended projection: 'Tis my interest and business to supply you with such materials, and such tools as I think most convenient: 'Tis yours to be diligent and industrious, to obey my orders, and improve your time to the best advantage. You philosophers, continue I, are guilty of the very same absurdity, and are equally blame worthy. Light and colours, which are your point in question, were bestowed upon us by Providence, to direct our judgment, and not to be the subject-matter of our enquiry or debate. As we are naturally curious, we would willingly, indeed, either search into the bottom of things, or else deny that they exist, because we can form no adequate idea of their natures.

These now are two extremes which are equally absurd. Let us therefore sit down contented with the enjoyment of light and colours, without being too inquisitive, without penetrating into all their properties; or, in case we are disposed to argue upon that point, let us not launch out too far; let our researches be adapted to our understandings, and always accompanied with a laudable view of some new improvement. Thus, without perfectly comprehending what light is, or the glass through which we find its rays are transmitted without obstruction, we may know how to make the glass, and so modify the passage of the light, as to help the weakest eyes, draw the most distant objects nearer to our view, and enlarge those whose minuteness renders them invisible to the naked eye. This now is a commendable way of exerting our faculties; this is the best manner of employing our hands, with respect to light. Or if we are resolv'd to confine ourselves to speculative knowledge, and argumentation; let us make choice of those subjects which may enrich our minds with such incontestable truths, as will prove of

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real service to us, enlarge our ideas, and affect us with a due sense of the valuable discoveries we have made.

If, for instance, we only reflect on the use of that light which was the point in question, is it not manifest beyond all contradiction, that there is not only a glorious design, but an alluring grandeur, and an important benefit and advantage that attends it? All nature, but a few minutes since, was involved in darkness; every object was lost with respect to us, as 'twas concealed from our eyes: The return, however, of the light, raises nature from a state of annihilation, as it were, and renders all her works advantageous to mankind. This alone, 'tis true, would not make one object sufficiently known from another. Were they all of a colour, the eye would be confounded. Each therefore appears in a dress peculiar to itself, or rather bears a ticket, or mark, by which 'tis distinguish'd without the least confusion. Their external forms by this means being thus easily discovered, save us the pains of tedious researches, and those uncertain reasonings which we should otherwise make on their respective natures and qualities, in order not to confound them. However, amongst a variety of colours, some are soft and refreshing to the eye, as green in particular; others are dull and gloomy, as brown or black; others are gay and lively, as white and red. Had either of the two last been diffused with a lavish hand over the face of the earth, our eyes would have been soon fatigu'd with the prospect. Was nature, for the generality, to appear in black, the earth would be clothed in mourning: But let her be dress'd, as for the most part she is, in green, the eye will be very much assisted and relieved, without our being able to account for the cause of so good an effect: Thus we see that the same All-wise Artificer, who formed the eye, has embellished the hills and plains, and in short, all nature round about us, with a profusion of that delicate, that soft verdure, which is so easy and so commodious to the sight. However, in order that the design in general of making one object distinct from another, might not, by a too uniform green, be in any measure defeated, I perceive that the verdure of a meadow is quite different from that of a field of corn; that each tree, each plant is tinged with a different hue; and that

the shades of one and the same colour so far vary the dress that is given to each body, that one is known and distinguished with ease from the other.

These are the first thoughts that occur to my mind on the subject of light, by which I would willingly dissuade my fellow-travellers from the two extremes of presumption and uncertainty; and prevail on them to have a greater regard for such truths as are plain and obvious. Of this kind are those which present themselves to us in every object that we see, in case we will but confine ourselves to such as are simple, advantageous, and necessary; and be equally cautious how we grovel for ever on the earth, when we have wings given us to raise ourselves above it, and how we mount too high, when we are once upon the wing. The purport of what I have here been treating of, may be reduced to one single maxim, which may be retain'd and practis'd with the utmost ease. In regard to all created beings that are obvious to our sight, there are but three particulars for the determination of our choice. One must be a resolution to know nothing at all: The second, an inclination to understand every thing; and the last, an ambition of prying into, and approving, as much as possible, whatever lies within our power, or the reach of our comprehension. The first particular is such a piece of indolence, as runs into downright stupidity: The second is an act of presumption, that never fails of being disappointed; and the third is the result of prudence and discretion, which, without too fondly aspiring to that which is above the reach of our rational faculties, is exercised with modesty and moderation, and enjoy'd with gratitude and submission to the Divine Will.

I am,

Dear Sir, &c.



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